NCE LIBRARY
McGraw-Hill Company, Inc.

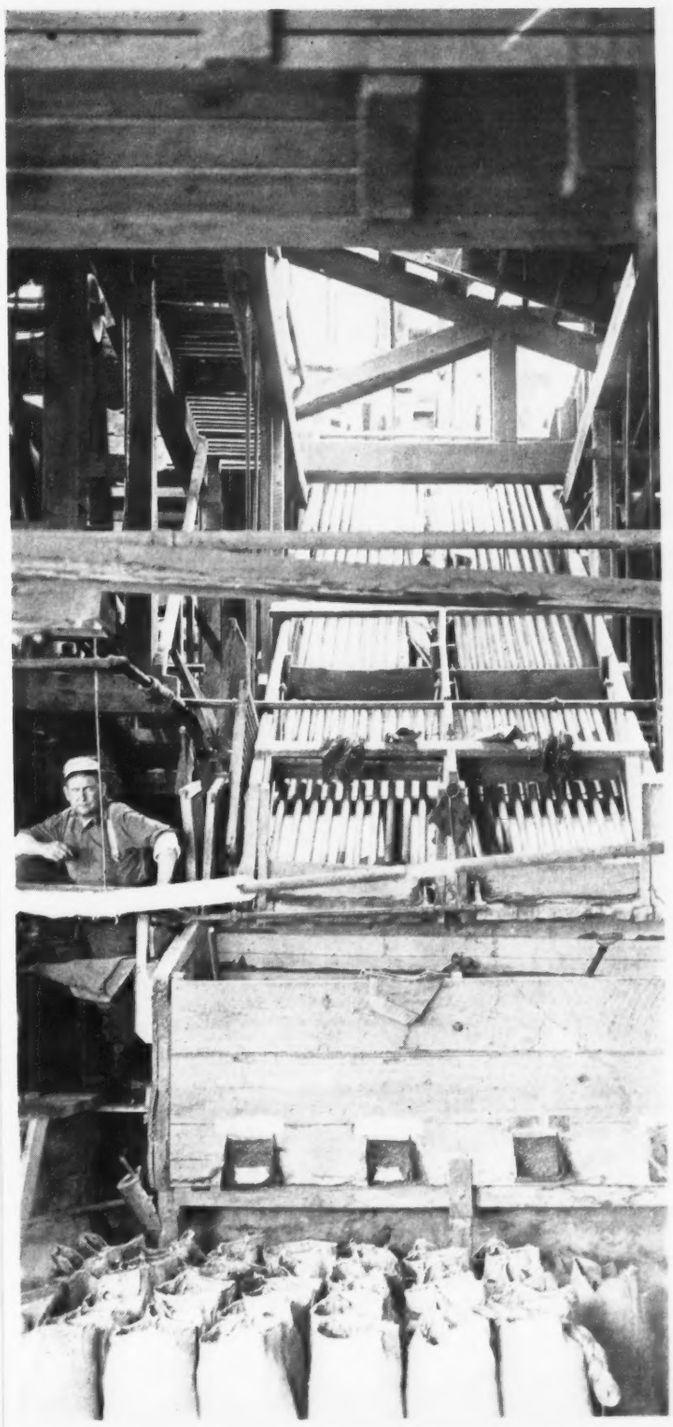
October 4, 1924

OCT 6 1924

Twenty-five Cents Per Copy

ENGINEERING AND MINING JOURNAL-PRESS

A CONSOLIDATION OF ENGINEERING AND MINING JOURNAL AND MINING AND SCIENTIFIC PRESS



Mining, Concentrating and Marketing Garnet

An Account of the Operations of the Largest Producer in the World

By Felix Edgar Wormser

Drying and Packing Garnet for Shipment

The mill of the North River Garnet Co. The concentrate is elevated to a large steam drier, shown here, inclined a little above the angle of repose. At the base of the drier is a bin holding about 10 tons of garnet ready for shipment to consumers

Preparing Garnet Abrasives

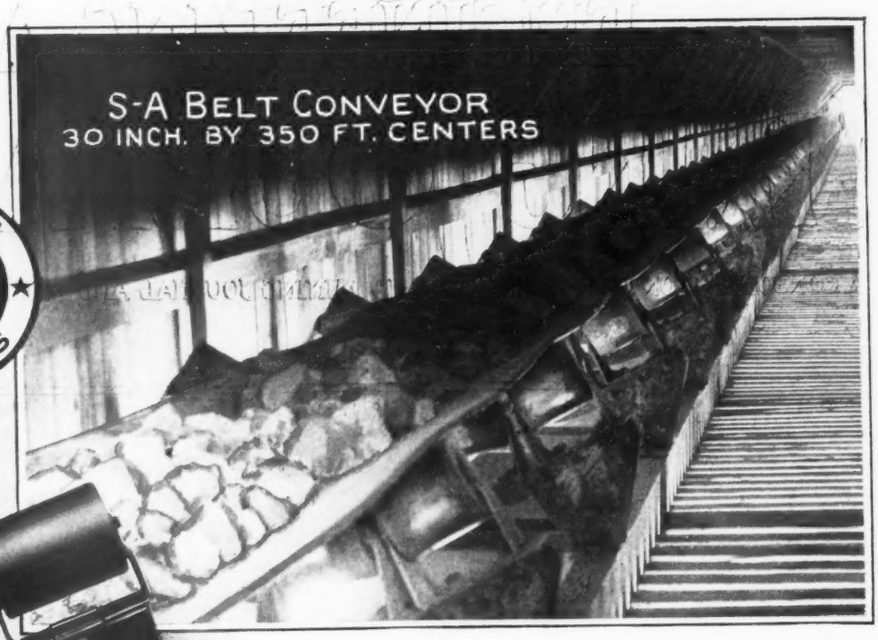
By Henry R. Power

Gold Veins of Sundry Areas in the Idaho Batholith

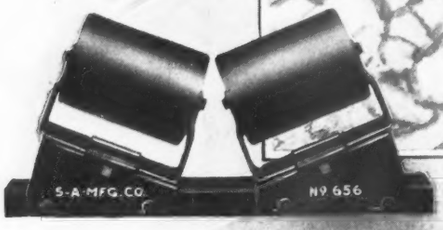
By Francis A. Thomson

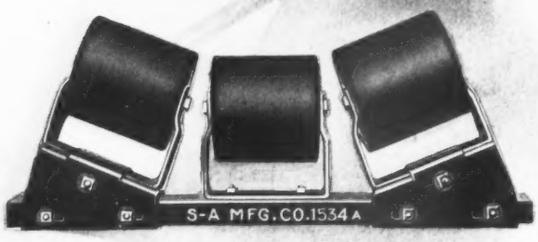
Biography of J. N. Houser

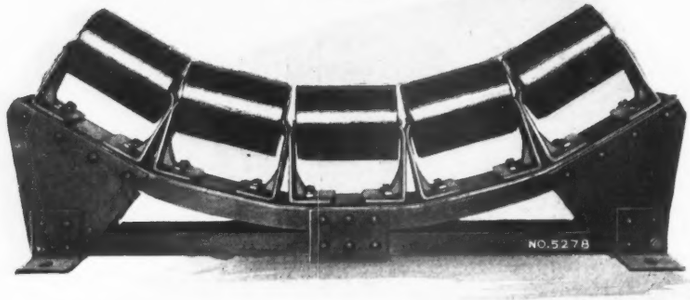
General Manager, Tennessee Copper & Chemical Corporation



AURORA S-A MFG.CO ILLINOIS







Longer life from conveyor belts

The quality of carrier used has much to do with the life of a conveyor belt. S-A ball bearing Unit Carriers are noted for the long life they insure to the belt, frictional resistance and wear on the belt being reduced to the minimum when gliding over these smooth, easy turning rolls.

S-A Unit Carriers are built of steel. They give far greater strength, in a lighter carrier. The flexibility resulting from the Unit design permits of adapting the carriers to practically any arrangement.

S-A Unit Carriers can now be furnished in the standard type or with high pressure lubrication fittings, the pressure lubricated unit being interchangeable with the other type.

S-A Engineers have been called "conveyor experts." Their experience justifies the expression and their knowledge of ore-handling problems is at your service without obligation.

STEPHENS-ADAMSON MFG. CO.

AURORA, ILLINOIS

ENGINEERING AND
MINING JOURNAL-PRESS

JOSIAH EDWARD SPURR, Editor

Volume 118 | New York, October 4, 1924 | *Number* 14

Conservation

THE CONSERVATION of natural resources is a thing to which we will, most of us, at once assent on principle. Beyond that the problem remains nebulous in our minds. The thought of conservation is connected most closely with the conservation of the forests, initiated by Gifford Pinchot with the support of Theodore Roosevelt when President. Whether this has worked out practically is a great question. The only thing, perhaps, that would be universally approved is the system of watching against forest fires and assuring the availability of men skilled in guarding against and extinguishing fire. Yet the placing of useless academic restrictions on the utilization of the forests in many cases has served as an argument against the system. We recall scraggly growths of mature scrub pine and even juniper, on hill slopes in the desert, which were shut off from any use, by the watchfulness of the government. A case also is reported to us from California where the government has frustrated every effort to cut and market mature trees, which afterward were destroyed by fire. There is no sound principle involved in keeping mature forests from utilization indefinitely. Ripe timber, like ripe grain, should be cut: the forester's job is to see that new forests of the right sort of trees are started at once and protected. Conservation does not mean hoarding.

When we consider conservation as applied to minerals, a definite program is even less easy to outline. The ore should come out of the ground, for it is of no value there; the problem is as to the time and scale of extraction. From a national viewpoint the sound policy would be, at first sight, to buy metals from whichever source they could be obtained most cheaply, whether at home or abroad; but cases like coal and iron show that this cannot safely be held as the only consideration. A native mining industry is not only a source of wealth, but a powerful safeguard to the nation's peace and protection. Countries like Argentina, which have no adequate coal and iron industries, are greatly concerned to obtain these if possible. In a lesser way this applies to other mineral products.

Katanga's Hot Pace

BY PRODUCING 20,411,685 lb. of copper during August, Union Minière du Haut Katanga maintains the position it won in July of being the largest copper producer in the world today. Production amounted to 11,400,000 lb. last February and increased steadily to 18,800,000 lb. for July. If any reward or prize were attached to the honor of taking the leadership, some copper-mining companies in the United States and South America would not have much difficulty in beating Katanga's mark. They have done so in the past and could repeat if they wished. But thirteen-cent copper is no inducement to remove the brakes, and other mining companies are wise in conserving their assets.

Unfortunately, the output of the African producer cannot be compared directly with official figures of production of North and South American copper mining companies, because most of them continue to keep their monthly record confidential. Total United States production is also kept secret. Even the statistical compilations of the Department of Commerce are now devoid of any reference to current monthly production. In fact, it seems that after every editorial we write upon the subject the screws are tightened all the more, and added precautions are taken to prevent the figures reaching the public. Such is the influence of the press!

However, the secrecy supposedly guarding the statistical record is easily penetrated by those in close touch with the copper market, manufacturers, and students of the trend. It doesn't require supreme intelligence to make a guess that is a serviceable approximation. And while the American copper mining industry is "solving" its difficulties by withholding statistical information from the public, Katanga merrily keeps to its course, increasing production from month to month and broadcasting the figures throughout the world without fear or favor. Katanga is evidently pursuing a policy dictated purely by its own position in the copper-mining industry and its interpretation of conditions. One cannot help admire the independence and success with which this great enterprise in the heart of Africa has been conducted.

Lightning Protection for Oil Tanks

OIL-TANK STORAGE for crude and manufactured products is a necessary feature of the petroleum industry. There is always a fire hazard. The recent oil tank fire at Monterey, Calif., resulted in two dead, eight unaccounted for, $1,500,000 worth of damage, the crippling of telegraph and telephone communication, and the destruction of power lines, roadways, and railroads. In addition, the town of Monterey was endangered. All resulted from a lightning stroke.

Protection of oil tanks from the ordinary sources of fire has been well worked out, but protection from lightning, which appears to be the source of most of the tank fires, demands thorough investigation. The Petroleum Institute can do nothing better than speedily to work out a rational plan for lightning protection. The co-operation of the research departments of the great electrical manufacturing companies can be no doubt secured. A practical plan for protection can be devised and should be applied to all tanks in which petroleum or its products are stored in near proximity to towns and cities.

California Water and Power Act

EFFORTS TO REVIVE the corpse of the California Water and Power Act which was crushed by the voters when submitted to referendum vote are being made in California by its solicitous fathers. Well might they give their best efforts, for the act provided for the spending of $500,000,000 of the taxpayers' money, with unlimited power to dabble in water-power projects in a state where private power companies, under close governmental supervision, have contributed enormously to the state's well-being.

Walter Stalder, petroleum geologist, speaking recently before the Commonwealth Club of San Francisco, called attention to the work of mining and metallurgical companies in the development of water for mining and irrigation purposes and the generation of cheap hydro-electric power for the initiation of electro-chemical industries. In his opinion the proposal to form a new state commission of unknown composition for the expenditure of $500,000,000 for water-power development seems superfluous under existing conditions.

Abbot A. Hanks, in an address before the same club, advocated the co-operation of irrigation, placer mining, navigation, and electro-chemical interests in building impounding and storage dams and their maintenance. He stated that power and mining companies are now co-operating and there is room for expansion of the same spirit.

As Mr. Stalder states, the proposed legislation is unnecessary and dangerous to the economic status of California. The evidence of co-operation mentioned by Mr. Hanks indicates that various industries are combining their efforts to a common purpose. They can do this more efficiently and to better advantage than any politically appointed commission. Less experimentation with the people's money is the need of the times.

Differences in Cost of Industrial Accident Insurance

INDUSTRIAL ACCIDENT INSURANCE is an excellent provision both for the worker and the mining company. The burden of expense is thrown directly upon the enterprise. The mine must not only earn its direct operating expenses, but it must also earn taxes and compensation insurance. The worker receives at no expense to himself as complete protection as can be afforded. In effect the cost amounts to an increase in wages. The equity of this may be open to question, but it is a fact. Under the circumstances the mining companies can with propriety insist upon the most economical administration of the funds for this purpose. Yet wide differences exist. For example, mine operators in California pay from $6.54 to $7.19 per $100 of payroll expense, whereas Nevada operators pay only $2.50 per $100 of payroll. Another rate, ranging from $1.78 to $2.23 per $100 of payroll, applies to mill labor in California. The corresponding rate for mill labor in Nevada is $1.50 per $100 of payroll.

Rates are made in California by the California Inspection Rating Bureau, which considers the number and kind of all accidents in all industries. The state issues accident insurance and does 50 per cent of the business. The remainder is divided among about forty private insurance companies. The cost of operation of the State Accident Insurance funds amounts to 13 per cent of the premiums paid. The range of rates is predicated upon the distance to medical aid, the mines less fortunately situated paying the higher rates. A blacksmith's wages pay as much premium as a miner's, although the risk is much less. This condition has arisen from the desire to make the general rate as low as possible, which has been effected by including the greatest number of employees in each classification.

Although the Nevada rates are the lowest, the compensation paid beneficiaries is the highest. The fund collected upon the premiums received is administrated by a commission appointed by a board of elective officials, of which the Governor is chairman. State insurance in Nevada is entirely in the hands of the commission. No private insurance companies do business in this state. The administration costs are 9.65 per cent of the premium income.

As the payroll in mining operations constitutes from 50 to 60 per cent of the total direct cost of mining, it is evident differences of the kind indicated are well worth investigation. Why should California mine operators pay more than twice as much as Nevada operators? The administration cost in California is higher, for one thing; but we see no reason why it should be.

China's Mineral Resources

IN A PAPER published by the China Institution of Mining and Metallurgy, Mr. Chung-Yu Wang discusses the "Relation of Tectonics to Ore Deposits, and Their Bearing on Chinese Deposits." The views he presents are worthy of more than a passing mention, comprising, as they do, an explanation of the "paucity of mineral deposits in China." This theory is therefore not only of great scientific interest, but will be considered attentively by those who are interested or propose an interest in the exploration and development of China's mineral resources.

By way of introduction, Mr. Wang observes, calling attention to igneous intrusions as the source of ore deposits:

> "We have given the theories of Ascension, Descension, and Secretion a decent burial, although they may be, at times, of some service to us. We know that ore magmas and rock magmas are intimately connected; and that pegmatites, dikes, and veins are different phases of the same thing—that is, they are the products of the differentiation of the same intruding magma. Indeed, we may conceive this fundamental magma as a solution or a mixture of solutions and not as a melt, containing three phases, solid, liquid, and gas, to which the laws of differentiation are applicable. . . . In fact, ore solution is a highly specialized form of igneous magma; in it, water and so-called mineralizers or metal carriers (fluorine, chlorine, and boron) play an important part. With the intrusion of a magma, the temperature gradient gradually lowers as it ascends toward the surface. First the lime silicates are differentiated and solidify out; then silica and and the iron sulphides; and finally ores of copper, zinc, lead, silver, etc. Following this line of reasoning we have what Spurr calls 'the dry phase, the aqueous phase, and the aqueous-gaseous phase of magmas—that is, the aplitic, the pegmatitic, and the superpegmatitic magmas.' Naturally, we may expect the superpegmatitic magmas to be the most prolific mother of most vein deposits. In fact, we may conceive of ores as the 'juice' of rock magmas, which differentiates and solidifies last."

Mr. Wang next calls attention to the fact that the metals ("metallogenic" elements) are the heaviest elements in the crust, and that their specific gravity is no doubt one of the factors why they occur much more rarely in the superficial crust than the lighter

"petrogenic" elements which constitute the crust. This general statement it will not be difficult to accept. He then proceeds to argue that as the source of metals is more deep-seated than that of the rock elements, only those upward rock-magma surgences which have originated at great depths will have brought up sufficient metals to form important ore deposits.

Considering the different theories for mountain-range building, Mr. Wang concludes that at least there is evidence of two distinct types of mountain-making forces—the vertical or radial force, and the horizontal or tangential force. Chamberlain is cited as believing that dominant vertical movement gives rise to "thick-shelled" mountains, while dominant tangential force originates "thin-shelled" mountains; and Mr. Wang, applying these conceptions to ore deposition, advances the idea that the rock flowage in the latter type does not come from a zone deep enough down to tap and bring up a portion of the storehouse of metals which lies in the "barysphere." He says:

"These ideas of Chamberlain are pregnant with meaning when taken into consideration with ore deposition. We learn that the metallogenic minerals are stored way down deep in the barysphere. Hence, if we want to tap, so to say, this storehouse of ore minerals, we must resort to the application of a force that is far-reaching and profound. It is this vertical or radial force, as conditioned by isostatic adjustment, that causes the upwelling or surgence, to use a term coined by Spurr, of the magma in depth, bringing with it whatever ore minerals happen to exist at the time, along the lines of weakness of the crust, which are located principally between the margins of the continental plateau and the foredeep or trough of the oceanic basin. Conversely, the horizontal or tangential force that causes the development of thin-shelled mountains is not profound enough to reach into the deep region of the earth, and, hence in mountain chains thus originated, no important ore deposits are expected to be found. We thus see that any discussion of the origin of ore deposits is involved in that of mountain formation. Indeed, both problems are one and same."

Accordingly, he divides the principal mountain chains of the world into two main classes—the coastal cordilleras and the arcuate mountain ranges; the former group he believes comprise mountains due mainly to deep-seated flowage, exerted vertically; the latter to more shallow flowage, exerted horizontally. It is, therefore, mainly in the former group that we may expect ore deposits:

"We know, however, from gravity measurements given by the advocates of isostasy, and the specific gravity determination of rocks given by Washington, that the rising positive coastal chains are composed of lighter rocks of low specific gravity, while in the sinking negative deeps are the heavier rocks, of higher specific gravity. Thus, we can draw the only inference that in order to maintain isostatic adjustment, the rock had to flow from under the ocean to bring more material into the column under the mountain areas, with great telluric pressure, which urged the rock magmas vertically upward, bringing with them the metallogenic minerals from the reservoir of the abyssal deeps to form intrusions, either as batholiths, sills, dikes or as veins, according to the strength and character of the invaded rocks and the temperature and pressure controlling their differentiation and segregation. Along such regions of the earth are located the most famous metalliferous mines of the world.

"Now, let us see what connection there is, if there is any, between the so-called arcuate mountains and ore deposits. Here we have a different story. The horizontal or tangential forces that produced these pronounced mountain chains must have been very superficial, capable only of folding and overthrusting but not profound enough to reach down to the storehouse of the metallogenic minerals buried in the barysphere. Hence ore deposits in such regions are sparse and scarce."

As to the assignment of the earth's mountain ranges to one or the other type described in the foregoing paragraph, Mr. Wang says:

"In a general way we may say the long coastal mountain chains in the western part of the two Americas, girdling the Pacific, from Alaska to the southernmost part of Chile, owe their origin to radial or vertical forces; while the syntactic mountain chains, beginning with the Pyrenees, passing through the Alps and the Caucasus and continuing to the Kuenlun and Tsinling around the north of Tibet and to the Himalayas, around the south of Tibet, are chains of the thin-shelled type; that is, they owe their origin to tangential or horizontal force. The richness of various kinds of ore deposits found in the former can be contrasted at once with the paucity of such in the latter."

In summing up, the author applies this theory to the mountain chains of China, and, respecting their origin he concludes:

"Finally, I conceive that in the development of the most of the mountain chains of China, the horizontal tangential force has played the most important part, and hence most of the mountains belong to the thin-shelled type. And therefore, on tectonic grounds, thus outlined above, I am justified in concluding that there is little hope for the future discovery of any large ore deposits in China, save perhaps in the western part of Szechuen."

Without attempting to pass judgment upon the criterion urged in Mr. Wang's paper, it is conservative to say that this theory is the result of clear and bold thinking, and well deserving of most thoughtful consideration.

Research Institutes

WE REPORT THIS WEEK the opening of an institute for plant research which has been founded by Colonel William B. Thompson, of Yonkers, N. Y., for the special study of plant diseases and other problems which menace the food supply of humanity. The opening was attended by many specialists in plant life; and all were enthusiastic as to the great need of such an institution. The federal and state agricultural bureaus, they pointed out, were busy on work which had a direct economic bearing, and on routine work in answer to popular demand. They had no leisure or facilities for thorough scientific plant research. The colleges were busy with teaching and with elementary experimentation. Hence the gap in the machinery for advancing science which Colonel Thompson has filled by founding the institute, which he has endowed with four millions of dollars. The mining industry may well boast of such a far-seeing and public-spirited philanthropist.

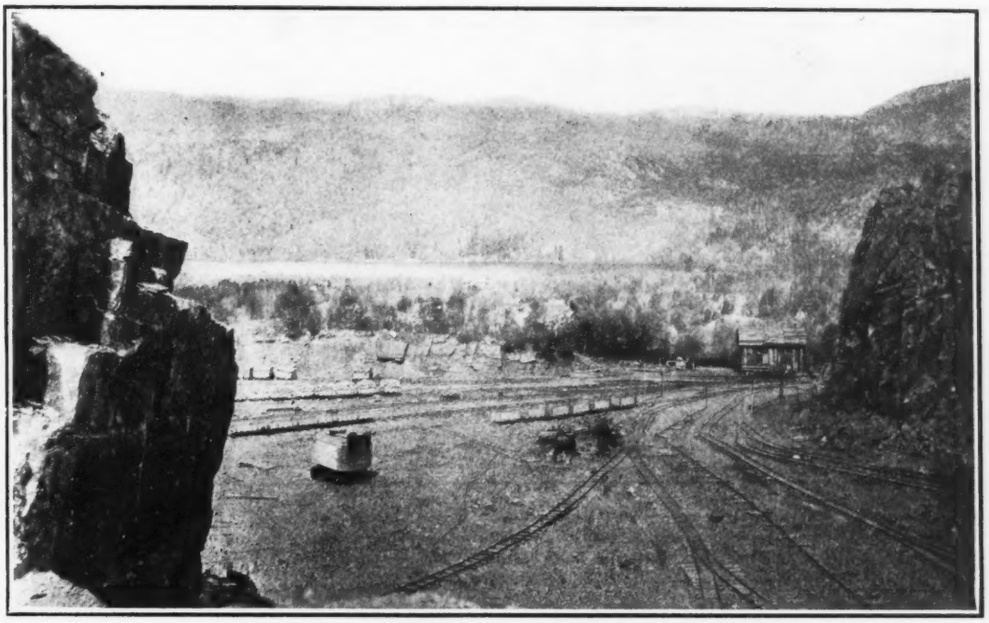
These views, and these arguments, are exactly those which are to be advanced concerning the science of mining geology, which languishes for the need of a similar institute. The case is absolutely parallel. The development through scientific research of the abundance and security of plant food for the future is a necessary and noble work. The development through better scientific knowledge of a more secure supply of the metals and minerals which are the sinews of civilization is perhaps a still more pressing need at present, and one which will be somewhat critical in the not distant future. We suggest to someone of those who have become prosperous through exploitation of the mineral wealth of the earth to do for the mineral industry what Colonel Thompson has so creditably done for the agricultural industry.

Mine Managers of Note

J. N. Houser

IT IS on his marked ability for handling men and on his talent as an organizer that those who are intimately acquainted with the present manager of the Tennessee Copper & Chemical Corporation lay principal stress in accounting for his success. To him the understanding of human engineering is of as much, if not more, importance than technical knowledge, they say. Such an understanding, coupled with a pleasing personality and with the vision and ability to see through a problem quickly and arrive at a prompt decision, is considered by his associates to be chiefly responsible for his rise to the position he now occupies. Probably the years he spent in Colorado working in smelters and mines gave him that perception of the workman's viewpoint that is often wanting in technical graduates. A survey of the route by which Houser has advanced is interesting. To many his progress will appear remarkable, for he is still a young man and has held other important positions prior to his going to Copperhill in 1919 to take over the management of the Tennessee company. What he has done he has accomplished without influence and without the advantage of a technical education. This latter apparent disadvantage may have indeed been only apparent, for he was thus enabled to get a much earlier start in the mining business than would otherwise have been possible. He was born in Summit Hill, Pa., in 1882. After a common school education he went to work in the office of the Guggenheim Exploration Co. in New York City. Then his Western experience began, with his going to the Silver Lake mine at Silverton, Colo. Later he returned to the Guggenheim office for a short period, at the close of which he went to Colorado once more, this time to Denver, on work of testing various ores of the Guggenheim properties in Mexico. From here he went to Mexico, to Velardeña, in Durango, to do similar work, and thence to Cananea, where he was employed in the concentrator under David Cole. From Cananea his route took him to Bonanza, Zacatecas, to a position under the late R. C. Gemmell, thence back to Cananea and then to Callabacillas, in Chihuahua, in 1908. Thus by the time he had reached the age of twenty-six he had already obtained a considerable and varied experience in mine, mill and office work in many camps and had had the advantage of working in close contact with men of mark in the mining profession. In 1909 he became manager of the Sierra Mining Co. in Cananea. In this year he married Miss Frances Piollet, of Wysox, Pa. In 1910 he became manager of the Calumet & Sonora Mining Co. at Cananea, and installed the first electrostatic separating plant in Mexico. In a wet mill the company had been separating a lead concentrate and accumulating a large tonnage of a middling of zinc, iron, copper, and barite, which the electrostatic plant later successfully separated into marketable products. In the latter part of 1911 he went to Carthage, Mo., in charge of mines in that district for the American Zinc, Lead & Smelting Co., and in 1914 went to Mascot, Tenn., to look after its operations there. Three years later he went to St. Louis, Mo., as vice-president in charge of mining operations of the company. While at Mascot he had an interesting experience. In December, 1915, No. 1 mine of the company there was flooded through a crevice in the outcrop under Flat Creek. At this time the war was in progress, and the demand for concentrates was heavy, and as the flooded mine had more than 100,000,000 gallons of water in it, and a rather heavy current inflow, it was thought that none of the usual methods of unwatering could be used. After some investigation, four Layne-Bowler pumps were purchased in Los Angeles and shipped to Mascot by express. To use them it was necessary to convert horizontal motors to vertical, which was accomplished, and two pumps were installed in each compartment of the shaft, and the mine was unwatered in about forty-two days from the time it was flooded. Houser returned to Mascot in 1918 in the same work and in the following year he took over the management of the mines, smelter and huge acid plant of the Tennessee company at Ducktown and Copperhill. He makes his home in Knoxville.

J. N. HOUSER



Open cut of the North River Garnet Co.

Note the blocky nature of the garnet-bearing rock as shown on the left. The mill is situated behind the bluff to the right. Thirteenth Lake can be dimly seen in the background.

Mining, Concentrating, and Marketing Garnet

Operations of the North River Garnet Co. in the Adirondack Mountains— The Largest Producer in the World

By Felix Edgar Wormser
Assistant Editor

PRACTICALLY the entire garnet[1] output of the United States comes from Warren County, N. Y., in a beautiful part of the Adirondack Mountain region. Most of the production has been made by one enterprise, the North River Garnet Co., which has occupied a leading position in the development of the American garnet-mining industry. The company has been successful in its operation where others have failed, and has been producing the mineral for thirty-one years. Its production is now between 4,000 and 6,000 tons of garnet per year, which is shipped to the leading abrasive paper and cloth manufacturers of the country. The total garnet production of the United States for 1922 was 7,054 tons; for 1923, 9,006 tons.

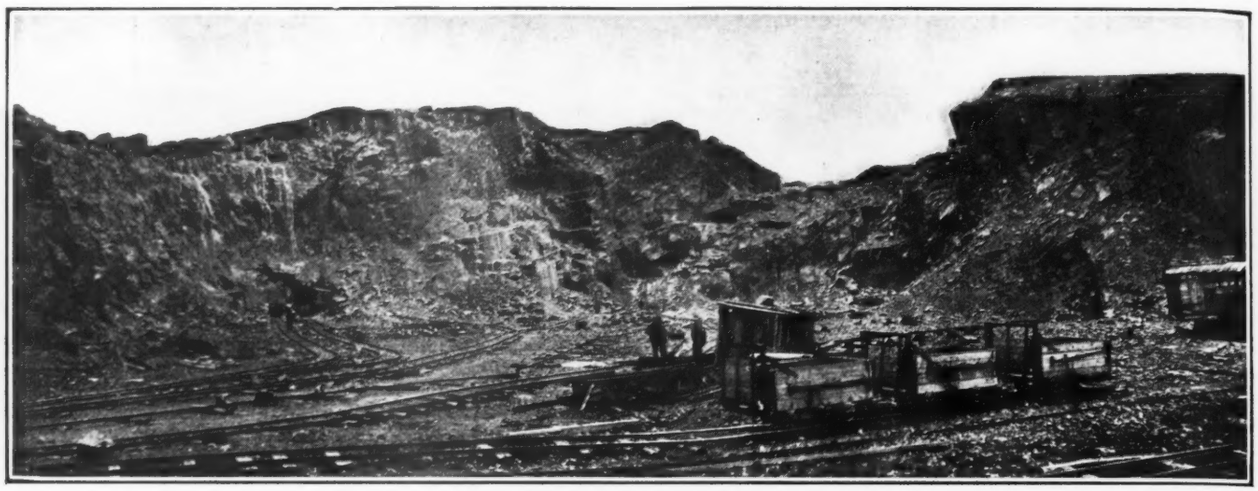
The North River garnet is mined from a quarry 10 miles from the town of North Creek, a terminus of the Delaware & Hudson R.R., running north of Saratoga Springs. The property is on land leased from the State of New York for a payment of 2 per cent royalty from sales. The variety of the garnet produced in the North River district is almandite, an iron-aluminum garnet, with a deep brownish-red color having a specific gravity of 4.25 and a hardness of 8 in Moh's scale as determined by the late Professor Moses, of Columbia University. Ordinarily, the hardness of garnet is 6.5 to 7.5. The utility of any garnet depends upon its hardness, toughness, cleavage, fracture, and purity. Almandite is harder than quartz but not so hard as emery and corundum. Toughness is perhaps the most important quality, because it determines how well the garnet stands up in use under pressure. Sharp cutting edges are demanded of the crushed garnet grains, a crumbly garnet being practically useless for abrasive purposes.

The source of the North River garnet is a large knob of garnetiferous gneiss in which a pit, open at the north end, roughly 300 ft. in diameter and 60 ft. deep, has been quarried, whose floor is at an elevation of about 2,150 ft. above sea level. The gneiss is undoubtedly a metamorphosed sediment of the Grenville series. Garnet occurs in reddish grains and crystals throughout the gneiss, often showing distinct but not very sharp crystal faces. The reddish color of the garnet assumes a coppery hue when the mineral is ground and ready for shipment. Crystals four inches and more in diameter are often found, but they average about one-half inch. Hornblende and feldspar are the principal gangue minerals.

As the garnet and hornblende have a specific gravity difference of only half a unit and less, the concentration of the garnet is a difficult and interesting problem. Some pyrite is also found in the rock. Miller concludes that the garnets have been derived from a recrystallization of the Grenville sediments found in the district,

[1]Garnet is a mineralogical term that includes at least six varieties, differing markedly in chemical characteristics, but having similar crystal habits and physical properties. They are all silicates of iron, calcium, aluminum, magnesium, manganese, or chromium. Dana classifies the garnet group as follows:

I. Aluminum garnet:	
Grossularite	$Ca_3Al_2(SiO_4)_3$
Pyrope	$Mg_3Al_2(SiO_4)_3$
Almandite	$Fe_3Al_2(SiO_4)_3$
Spessarite	$Mg_3Al_2(SiO_4)_3$
II. Iron garnet:	
Andradite	$Ca_3Fe_2(SiO_4)_3$
III. Chromium garnet:	
Uvarovite	$Ca_3Cr_2(SiO_4)_3$



Panorama of the quarry wall

Both steam-shovel and hand-loading operations are conducted. Quarrying operations have almost leveled the knob in which the garnet is found.

which were caught up and included in the great igneous masses at the time of their intrusion. The deposit gradually changes to a basic syenite in depth.

The quality of a garnet depends primarily upon the character of the old sediment from which it is derived and upon the composition of the intrusives that metamorphosed the sediment. In the North River property the sediments were acted upon first by anorthosite and later by syenite.

Operations are not much different from those of other quarrying enterprises. Three-foot-gage car tracks are laid on the quarry floor in the common "fan" arrangement, the end of each track leading to a working face. All the tracks converge to one line leading to the company's mill, which has been built on a steep hillside near the edge of the open cut. Two styles of cars are used to transport the garnet-bearing rock: a double open-end car for hand loading and a special car with gate and closed end for use in steam-shovel work. Both types are built in the shops of the company. The steam-shovel type holds five to six tons; and the open-end type eight tons. They are cheaply built and have proved highly satisfactory for the particular work they have been called upon to perform. An accompanying photo gives a view of the steam-shovel type. One simple movement of the bar locking the gate of the car is sufficient to release the gate. This movement is accomplished by impact with a stop placed at one side of a car dumper cradle at the head of the mill. The loaded cars run by gravity to the mill and are pulled back to the quarry face by a horse.

No attempt is made to work the quarry systematically with benches, as the rock is seamed very irregularly, although small benches are carried wherever practicable. The rock is tough and hard to drill. Drilling is done by two C-110 Ingersoll-Rand piston drills set upon tripods. The holes are drilled to about 15 ft. in depth. A No. 31 Waugh Turbro drill is at present being tried with the object of drilling 20-ft. holes and displacing piston drills. Common four-point cross-bits are used, forged from Swedish drill steel. The bench holes are sprung before being finally blasted. All ledge holes are loaded with 60 per cent —1¼-in. dynamite and fired with an electric blasting machine. The rock has a tendency to break into huge blocks, which require much block-holing. Block-hole drilling is done by DP-33 Sullivan machine, and the holes are loaded with 40 per cent —1-in. dynamite. Average production of rock for the last three years has been 3.7 tons for each pound of dynamite used for all purposes.

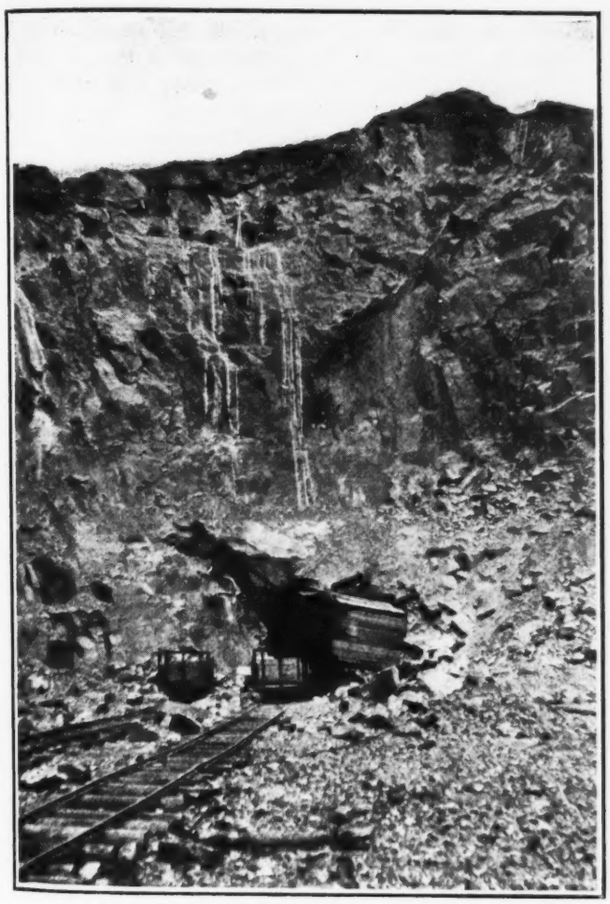
Where cars are not loaded by hand, a ⅞-yd. 18-B Bucyrus shovel on traction wheels does the work. Two shovels of the same model are used in the pit, so that while one is being used the other is repaired. The company also owns a ¾-yd. 14-B Bucyrus caterpillar shovel, which it uses in construction work, stripping, and odd jobs on the property. As the winter season is usually severely cold, and often halts operations, a string of loaded cars is generally kept on the floor of the quarry near the mill as a reserve. This also helps out the mill storage, which is none too large.

The mill of the North River Garnet Co. is a wooden structure built more than nineteen years ago on the side of a hill at the edge of the quarry. At the time that it was designed and first operated, no one had ever successfully concentrated garnet on a large scale, so that the work was of a pioneer nature. The small specific gravity margin between the garnet and the gangue minerals—one-half unit—necessitates careful work by gravity methods. Flotation was, of course, out of the question. Machinery had to be specially devised by Frank C. Hooper, manager of the company, to do part of the work. Stage crushing with jaw crushers and rolls, followed by jigging and concentration with special machines, is the practice now followed. Fortunately, the garnet is easily released from the enveloping gneiss by crushing, so that the individual grains of the final product are exceptionally clean. Stage crushing was chosen because of the necessity of avoiding fines, which have no market value.

The rock as it comes from the quarry in large lumps is fed by hand into a 24x36-in. jaw crusher set to 8 in. It then passes to a small 30-ton bin feeding another jaw crusher 18x24 in. set to 3½ to 4 in. This crusher discharges on a 20-in. belt conveyor, which elevates it to a shaking screen having ¼- and ¾-in. openings, the latter to relieve a 10x20 crusher of fines in the feed. The oversize of the ¾-in. screen goes to a 10x20-in. jaw crusher which discharges on a shaking screen having ¼-in. openings. The oversize of the ¼-in. screen and

the undersize of the ¾-in. screen discharge into an elevator feeding a pair of 36x16-in. P. & M. rolls. The discharge of the 36x16-in. rolls is fed to a shaking screen having ⅜-in. openings, the oversize of which is passed through a pair of 24x12-in. swing-housing flanged-type rolls, and the discharge elevated to a ¼-in. shaking screen. Crushing again takes place in another set of 24x12-in. rolls, followed by screening on a ¼-in. screen and further crushing in a last set of 24x12-in. rolls. The discharge of the last set of rolls is elevated to the mill bin. All the undersize from the ¼- and ⅜-in. screens falls into the mill bin. The capacity of the mill bin is about 200 tons.

Although old and requiring constant attention, the crushing plant works satisfactorily. The garnet rock is

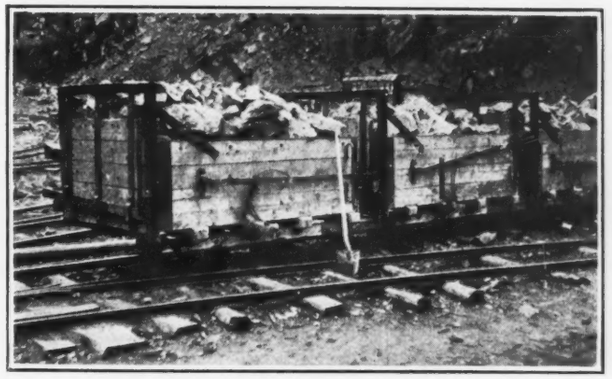


One of the steam shovels used

The streaks in the background were made by sludge from a tripod drill working on the quarry face.

tough and abrasive, but does not seem to be unusually hard on the roll shells. The roll shells of the 36x16-in. rolls last about fifteen months, and the shells on the 24x12-in. rolls from six to eight months. Chrome-steel roll shells are used and are machined down when they become corrugated. Manganese-steel wearing parts are used on all the jaw crushers. All the crushing is done dry.

From the main bin the ore is fed to four Harz jigs, which make two products only—a clean tailing to waste and a middling from the hutch for further treatment. Water is added at this point in the circuit. The jigs are two-compartment machines, each cell being 24x36 in. Head cells have ¼-in. square holes and the

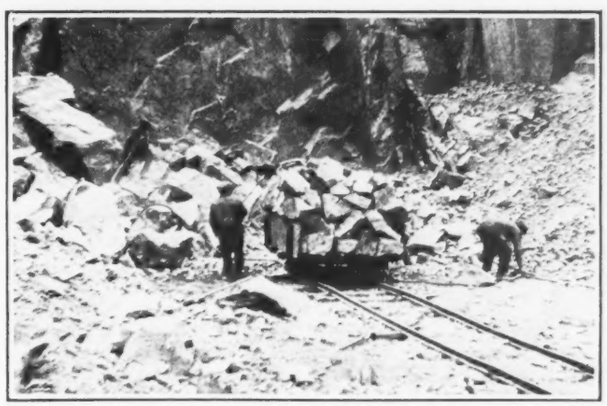


Type of steam-shovel car used

second compartments ⅜-in. screens. About every hour the jigs are skimmed by hand, and a product rich in garnet is recovered, which is screened and given additional treatment, as described below. The jig plungers have a stroke of two inches, with 200 pulsations per minute.

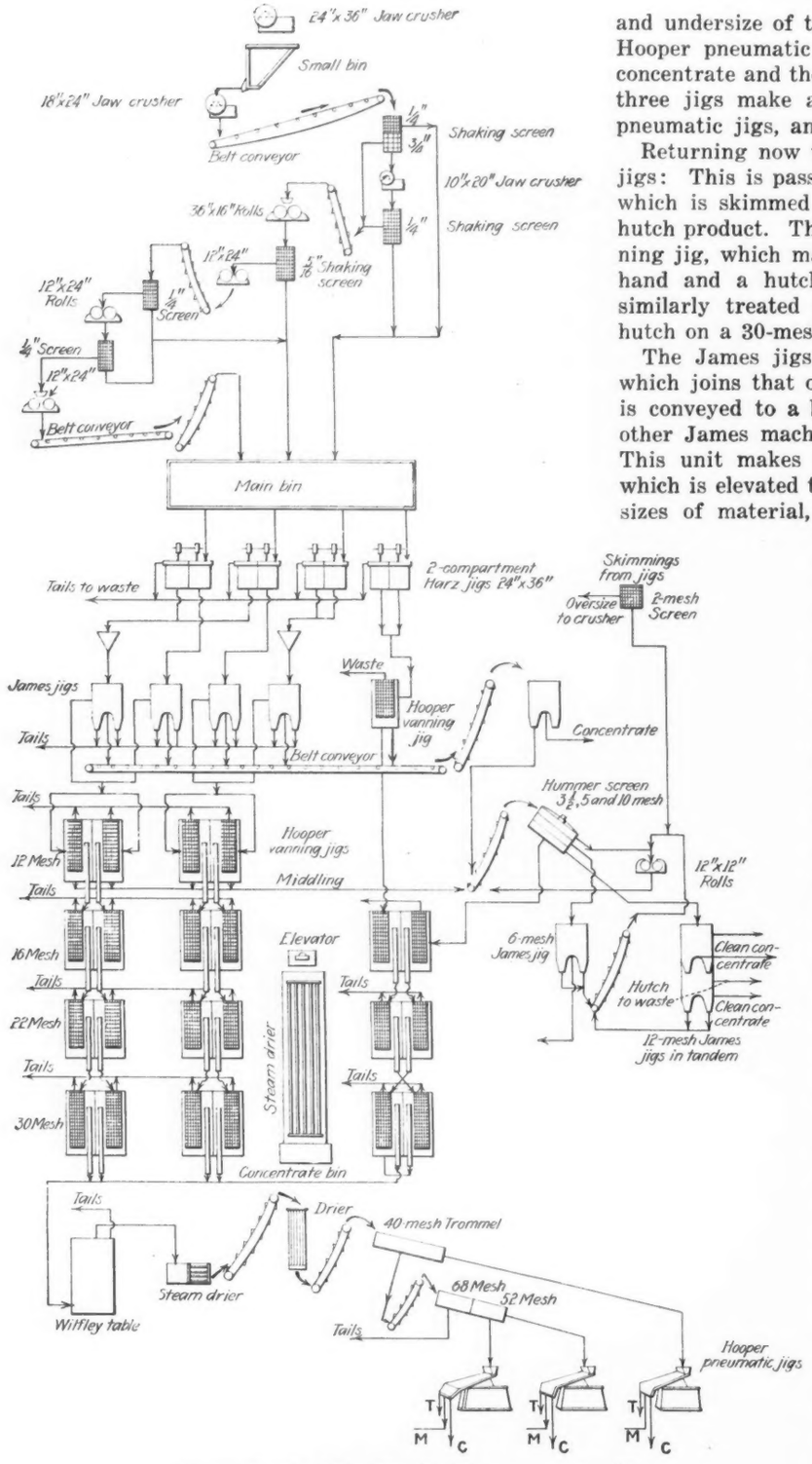
The hutch from the jigs is partly dewatered in two cones and then delivered to four James jigs, 24x36 in., having 6-mesh screens, a stroke of ⅜—½ in., and 225 pulsations per minute, and to one Hooper vanning jig having also a 6-mesh screen. The James and Hooper machines make three products, a tailing to waste, a middling, and a hutch product. The hutch is sent to a series of Hooper vanning jigs which were especially invented to treat the garnet sand. These vanning jigs are operated in series and contain screens of 12, 16, 22, and 30 mesh as indicated on the flow sheet. With the exception of the two head machines (12 mesh), all the units make a clean concentrate, which is removed by hand, and a product which is sent to a Wilfley table for concentration. Customary operation of this table was found to be unsuited for best results, and it is run more as a vanner than a table. No pulp flows over the riffles, the entire product pursuing a diagonal course across the deck of the table and dividing into a middling and a tailing. A small stringer of pyrite can usually be detected upon the table, which has a stroke of 1¼ in. and 250 r.p.m.

The Wilfley middling is dewatered and shoveled upon a small bucket elevator lifting the sand to a steam drier consisting of a grid of 10 steam pipes 10 ft. long inclined at an angle of 50 deg. to the horizontal.



Loading cars by hand

The work is done by contract. At the left a miner may be seen block-holing one of the large chunks in which the rock breaks.



Flow sheet of the North River garnet mill

Stage crushing and water separation on special machines is the practice followed.

and undersize of the 52-mesh section is passed to two Hooper pneumatic jigs, one making a 52- to 68-mesh concentrate and the other a 40- to 52-mesh product. All three jigs make a middling, which is re-run on the pneumatic jigs, and a tailing.

Returning now to the hutch from one of the 6-mesh jigs: This is passed to a 12-mesh Hooper vanning jig, which is skimmed by hand and makes a middling and hutch product. The hutch is elevated to a 16-mesh vanning jig, which makes a clean concentrate skimmed by hand and a hutch middling. The 16-mesh hutch is similarly treated on a 22-mesh jig and the 22-mesh hutch on a 30-mesh jig.

The James jigs mentioned above make a middling, which joins that of the single Hooper vanning jig and is conveyed to a bucket elevator for treatment in another James machine of similar design and operation. This unit makes a clean concentrate and a middling which is elevated to a set of Hum-mer screens for three sizes of material, 3½, 5, and 10 mesh. The oversize of the 3½-mesh screen is reduced in a set of 12x12-in. Chalmers & Williams rolls and elevated to the Hum-mer screen again, to join the skimmings from the Harz jigs which have passed through a 2-mesh screen. The 5-mesh oversize passes to a James jig with 6-mesh screens, making a concentrate and middling. The oversize of the 10-mesh screen is jigged on two James jigs running in tandem, fitted with 12-mesh screens and making three products, concentrates, middlings, and tailings. The middlings from both the 6-mesh and 12-mesh jigs are elevated to the 12x12-in. rolls for recrushing and screened again on the Hum-mer. The undersize from the 10-mesh screen is passed to a 16-mesh vanning jig and follows the circuit as described above over 22- and 30-mesh vanning jigs.

All of the concentrate from the various machines is carried by hand to a bucket elevator near the center of the mill, where it is elevated to a large steam drier 30 ft. long and 7 ft. wide, inclined a little above the angle of repose of the sand. The drier consists of two sets of ten pipes furnished with steam from the power plant. At the base of the drier is a bin holding about ten tons of garnet ready for shipment to consumers. It is a mixture of all the concentrates taken from the various points in the flow sheet and has the following screen analysis, an average of one year's shipments. From month to month the concentrate will show only slight variation from these figures:

	Per Cent
Plus 6 mesh	17.1
6 to 12 mesh	28.0
12 to 16 mesh	14.3
16 to 22 mesh	18.1
22 to 30 mesh	9.2
30 to 68 mesh	13.3
	100.0

Another bucket elevator then conveys the dried middling to a hexagonal wooden trommel, 8 ft. long and 2 ft. in diameter, covered with 40-mesh screen. The oversize, running 30 to 40 mesh, is treated on a Hooper pneumatic jig. The undersize is again elevated and passed through a second hexagonal wooden trommel screening to two sizes—68 and 52 mesh. All the material passing through the 68-mesh screen is discarded. The oversize

The product shipped is very uniform in composition and contains about 90 per cent garnet. Uniformity in the composition of any non-metallic mineral is a quality much to be desired and is a characteristic of the North River Garnet Co.'s output.

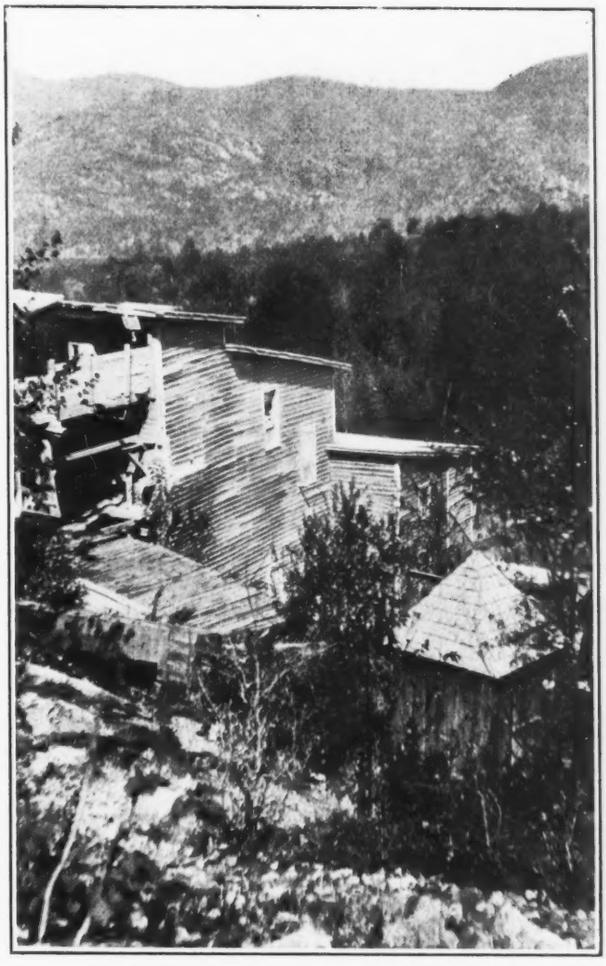
The garnet is sacked in jute bags weighing 130 to 135 lb. gross, sewed by hand, and placed upon two Pierce-Arrow trucks, which transport the load 10 miles to North Creek, where the material is loaded on freight cars. The bags are the property of the company and are returned by the consumers for refilling.

The flow sheet is necessarily complex—much more so than that of the average metalliferous concentrating plant. This is mainly because of the peculiar and difficult problem of concentration which had to be solved.

The James jigs used are of the movable sieve type. They are strongly constructed, and their appearance and action is shown in an accompanying photo and sketch. By the use of rocker arms and connecting links, a vertical reciprocating motion is imparted to the jig tray containing the garnet pulp, at a rate of about 225 strokes per minute. The stroke can be regulated while the jig is in motion. The jig tray is fastened to a rubber diaphragm over the hutch, so that on every down stroke the water is forced through the bed resting on the screen. On the upward stroke it leaves the bed. The sectional view of the jig makes its construction clear. The hutch is pyramidal in shape, the clear hutch water entering at the vertex of the pyramid. Owing to the fact that the screen on which the garnet pulp rests reciprocates vertically, and, further, because baffle plates in the hutch prevent the water from surging when the jig is operating, the pulsations are uniform throughout the area of the screen. The excellent work which the jig performs on mineral having small differences in specific gravity is doubtless due to these two circumstances, coupled with the accurate adjustment that can be made of the stroke. The depth of the bed used depends upon the size of the material treated and ranges from 2½ in. to 4½ in. The practice in concentrating North River garnet is to use a 3½-in. bed. Each machine has a capacity of 10 to 50 tons per day and requires 2 hp. to operate.

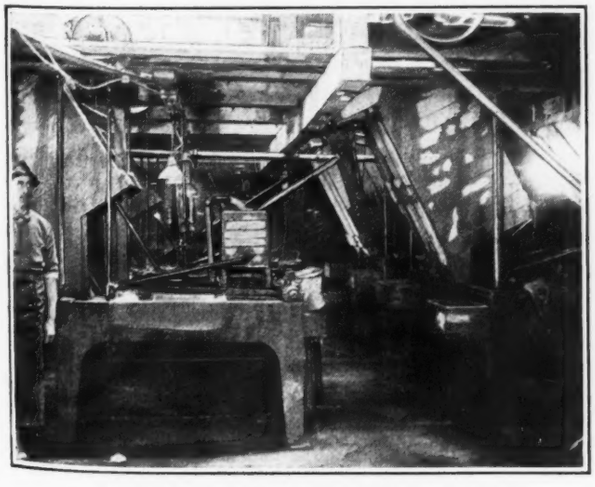
The Hooper vanning jig is a simply constructed but very efficient machine that was devised by Mr. Hooper to effect a close separation of the garnet from the gangue, and was the first vanning jig invented. It works best on 10- to 30-mesh material and consists of a triangular iron hutch divided by a longitudinal vertical partition into two compartments. Each compartment contains a shallow tray or sieve, which is suspended from an eccentric rod at one end and a stationary shaft at the other end in such a manner as to give the bed a vanning motion, which causes the concentrates to travel uphill on the inclined screen bed. Each screen has a slope of several degrees, depending on the size treated. A 4-in. rubber conveyor, with 3-in. buckets spaced 12 in. apart, removes the hutch material to the next vanning jig or other machine. Several photographs and a line drawing show the construction of the machine. A flanged and bushed pulley rotating on an extra heavy piece of pipe in the hutch carries each conveyor belt. This pipe also feeds water to the hutch.

In operation, the pulp is fed about one-third of the screen length distance from the closed end of the sieve, which is jigged in the hutch water. The heavier garnet sinks to the bottom of the sieve and works its way up toward the closed end, while the gangue discharges out of the open end into a launder. The screens have to be skimmed by hand when sufficient



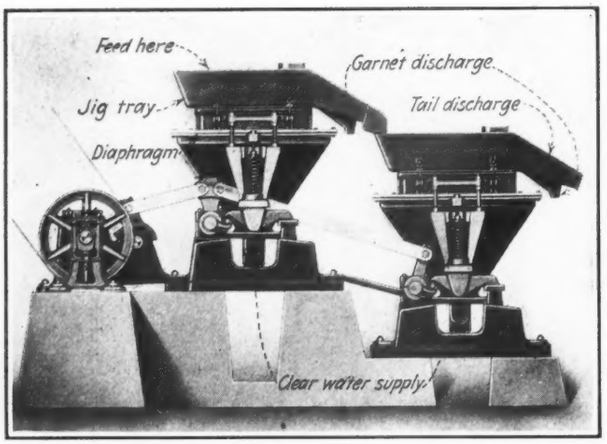
A glimpse of the mill

It is a wooden structure on a hillside location which treats from 400 to 500 tons of rock per day.



Battery of Hooper vanning jigs

These machines must be skimmed by hand. Garnet concentrates are placed in the old powder boxes shown at the end of each machine.



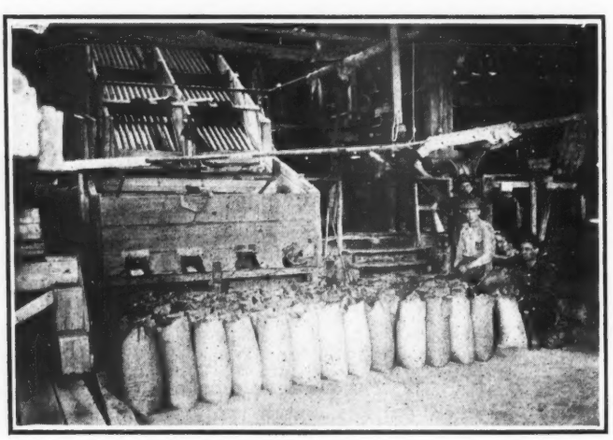
Two James jigs operating in tandem

They are the movable sieve type and play an important rôle in the concentration of the garnet.

garnet has accumulated, the rich garnet concentrates being placed in a powder box at the end of each jig. The screens have a stroke of ½ to 1 in. and make 240 to 330 r.p.m. Each sieve has a shoulder at the discharge end about 1 in. high for about a third of its length, so that the bed of ore is shallower at the closed end than at the open end. The machines make a splendid separation of the garnet from the gangue.

Air Jigs Used for Many Years

The Hooper pneumatic concentrator is shown in section in an accompanying sketch. It consists of a device for actuating a leather diaphragm, that pulsates air through a broadcloth deck on which the separation of garnet and gangue occurs. The diaphragm is operated by two eccentrics with adjustable stroke and contains flap valves to allow the air to enter the chamber on the down stroke. The concentrating top or deck is movable on a universal joint, so that it can be adjusted at any desired angle. It consists of a frame or grate upon which is stretched a piece of broadcloth. Resting upon the broadcloth is a peculiar riffle arrangement, consisting of two sets of brass riffles running diagonally to each other. The lower set is ¼ in. high with riffles 1 in. apart. The upper set, or "skimmers," rests upon the lower. The "skimmers" are 3½ in. high and ¾ in. apart.

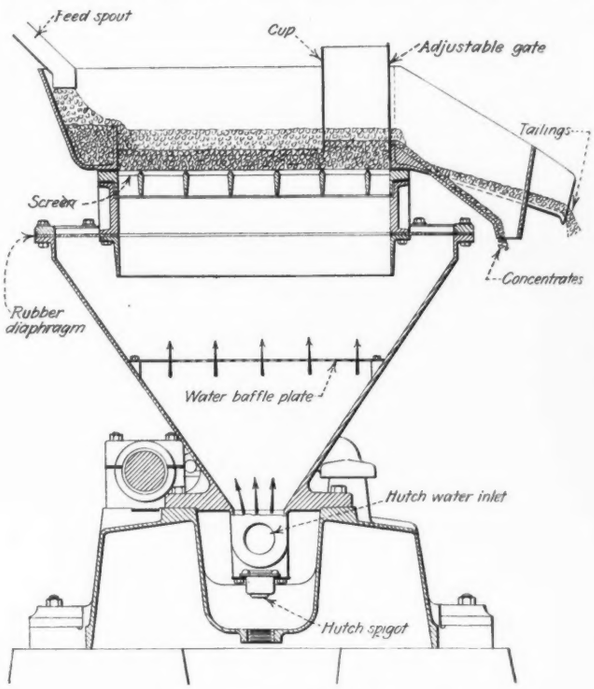


Drying and sacking the concentrates

Only one grade of product is shipped, a mixture of all the garnet produced. The jute bags hold about 130 lb. and are shipped to abrasive centers in the United States.

The crushed and carefully sized ore is fed to the pneumatic jig with a hopper. On its path across the table of the jig the pulsations of air cause the mineral to stratify, the garnet settling on the bottom and being guided by the lower set of riffles to one side of the table. After the lower set of riffles has become filled with garnet, the upper set of riffles guides the gangue toward the opposite or tailing side of the jig. Adjustable fingers or the discharge apron divide the product into concentrates, middlings, and tailings. The capacity of each machine is from eight to twelve tons per day, and each requires about 1¼ hp. to operate. The pneumatic jig was first developed in the graphite area of New York State, but has been successfully used in the concentration of other minerals.

The mill is driven by a tandem Corliss valve engine that has been running for twenty years and is served with steam from three 150 hp. Stirling boilers. No hydro-electric power line runs close enough to the



Cross-section of a James jig

These jigs are sturdily constructed and perform effective work on the garnet rock.

property to make installation of electric power feasible. Part of the steam generated also dries the garnet and heats the mill in winter. Coal for fuel has to be hauled 10 miles from North Creek.

All the Mineral Consumed by Abrasive Paper Makers

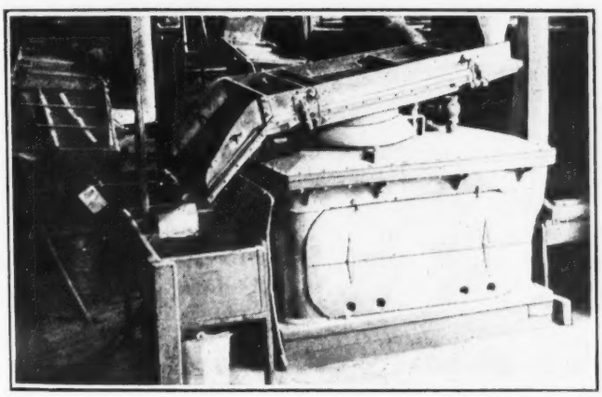
Two shifts of ten hours each are the practice. Owing to the large amount of hand labor required, eight men are needed on shift to take care of the various operations in the mill. The capacity of the mill is 400 to 500 tons per day. Mill water is discharged in a settling pond and then pumped back to the mill. The water supply has to be conserved, because of a frequent shortage. The management is constantly making experiments to improve its milling practice. At present a small Marcy rod mill is being installed to regrind the middling from the James tandem jig. Experiments

have been made with electrostatic separation, but they were not very encouraging.

North River garnet is shipped to the abrasive manufacturers in such centers as Chicago, New York, Troy, Niagara Falls, Boston, St. Paul, Philadelphia, and Williamsport. It is in good demand by them on account of its efficiency as an abrasive material. Abrasive-paper manufacturing is the only outlet for garnet production at the moment. It is not used in grinding wheels, because its low melting point interferes with vitrification. During the war some clear garnet from the North River property was supplied to watch manufacturers as a substitute for the rubies ordinarily used, but which were unobtainable then. A clear grade of hand-picked garnet was supplied, from a ton to two tons in all.

The natural abrasives used for sandpaper manufacture are emery, flint, and garnet. Although silica is a sharp abrasive, it is not so hard as garnet and does not wear so well in woodworking and leather polishing, the principal uses to which garnet is put. It is estimated to be about 75 per cent more efficient than silica paper. This remark applies particularly to the highest quality Adirondack garnet, probably the best in the world for the purpose to which it is put.

Tests of garnet under actual operating conditions are



Three Hooper pneumatic jigs

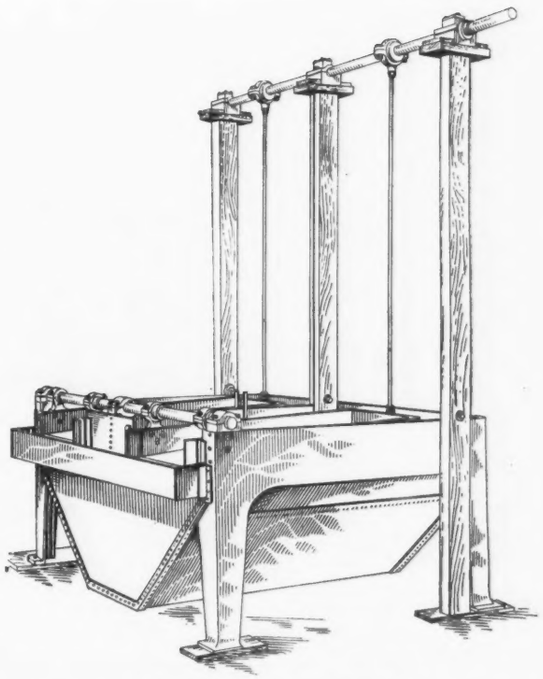
They treat the finely ground sand and make the last separation in the mill.

the only satisfactory means of determining its value. The fact that the material may come from one location in the Adirondacks noted for its garnet production is no criterion that any garnet found there is suited for abrasive-paper manufacture. Deposits separated by only a few miles may be closely related geologically, and yet contain garnet with physical characteristics differing widely enough to make one a far better abrasive than the other.

The abrasive-paper manufacturers take the crude Adirondack garnet and give it further grinding and grading treatment, as related in another article in this issue. (Page 832.)

At present Adirondack garnet is worth $85 per ton, f.o.b. cars.

Artificial abrasives do not compete with the natural garnet in the uses to which it is put. At least one manufacturer of abrasives is also an important consumer of garnet. Occasionally, some Spanish garnet is imported at a lower figure than the domestic material, but it is not so satisfactory an ingredient of abrasive paper as the Adirondack product. Spanish garnet is

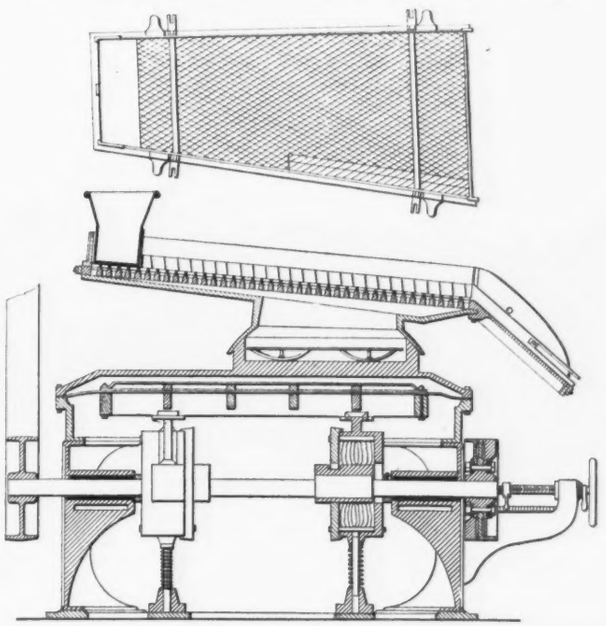


The Hooper vanning jig

The belt conveyors used to remove the sand from the hutch are not shown in this view, but may be seen in the photograph on page 529.

derived from alluvial deposits and consists of small grains showing distinct sharp crystal faces. When ground, the Spanish garnet does not furnish the sharp angular faces so characteristic of the Adirondack mineral. The Spanish supplies are said to be almost exhausted.

I wish to thank Mr. Frank C. Hooper, manager of the North River Garnet Co., and Mr. Herman H. Vogel, engineer, for the kindness and hospitality extended me upon my visit to the plant and the freedom with which they volunteered information about their operations.



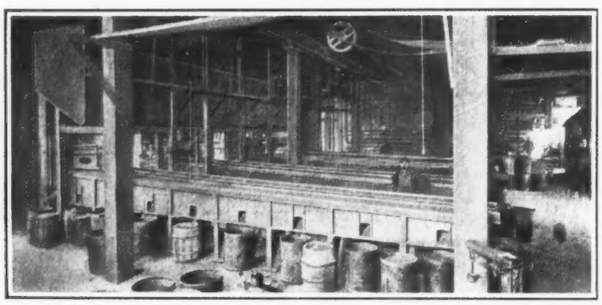
Cross-section of the Hooper pneumatic jig

This machine was originally developed for graphite concentration, but is used for other minerals.

Preparing Garnet Abrasives

By Henry R. Power
Technical Supervisor, The Carborundum Company

THE FINAL PREPARATION of abrasive garnet is pre-eminently a function of the manufacture of surface abrasives, because of the exactness of the specifications, requiring special equipment operating under the best mechanical conditions. The size of garnet received regularly is about 5 mesh and finer, from the Adirondack source of supply. In sizes of 2 in. and finer, the garnet on arrival is put through 8-in. rolls, which crack it to 20 mesh and finer. It is then roughly graded into several sizes, so that it may be further purified on vibrating tables, which remove the last portions of gangue yet remaining in the ore. The amount of this hornblende and feldspar gangue material which is permissible in the prepared garnet is very limited.



Grinding department where the garnet is classified

After drying the concentrated garnet, the next operation consists of grading or sizing it accurately over silk screens into the eleven standard numbers or grades which have been adopted by the American Surface Abrasive Manufacturers. In deciding what these sizes shall be, what control screens shall be used in their preparation and in laboratory control, several years' work by the technical men of the abrasive manufacturers in conference has been necessary. As a result of their pioneer standardization work, there is now in the hands of each producer of garnet paper and cloth a set of standard garnet numbers of a grading that combines the most efficient functioning with the highest commercial yield. As an illustration of the closeness of this grading, it is sufficient to say that no more than 5 per cent of the next coarser number is permissible in any grade. The sizes of garnet range from 20 mesh, known in the trade as No. 3½, through No. 3, 2½, 2, 1½, 1, ½, 1/0, 2/0, 3/0, 4/0, 5/0, 6/0 and 7/0; the latter 220 mesh.

To get this standard product, each manufacturer has special sifting equipment more or less of his own design, but all capable of yielding the same product. To control the operation, constant laboratory testing is necessary. Every manufacturer is therefore putting on the market a product of equal coarseness in each number, so that a customer may purchase and use the various manufacturers' goods with no interruption in his own processes. This standardization, by elimination of waste, has been of great economic value.

The closely graded garnet is now ready for the coating process, which makes use of machinery well known in the printing, textile, and paper-making trades. The paper or cloth from a large roll passes continuously over a roll dipped in a glue solution, which coats one side with a thin layer of glue; thence it goes under a hopper containing the graded garnet, falling in a shower on the glued side. The excess garnet is shaken off and the sheet is carried to racks to dry.

To anchor the garnet more firmly to the sheet, or "backing," a second coating of glue is run over it, forming the "sizing" coat. All of the processes require accurate laboratory control of the coatings of glue and garnet abrasive. The product after drying is cut into the various shapes and sizes required in the trade. Glue of the highest quality hide variety is employed.

The cloth "backings" used are drills, jeans, or twills; the paper is made of rope in most cases, but Kraft paper has been used in some instances. All of the weights and kinds of paper and cloth backing have been standardized by the Surface Abrasive Manufacturers.

The uses to which garnet paper and cloth have been applied have been chiefly in the wood-working industries, not only for handwork, but as belts; for drum sanders and other modern machines which put the product to a severe test. Only the highest quality of material can be employed in making surface abrasives.

That the abrasive industry has kept pace with modern demands upon it is illustrated by the recent development of waterproof garnet paper for the paint and varnish trade, which permits of the rubbing of these materials with water, thus eliminating dust, cutting down the time of operation and yielding a better finish.

Garnet abrasive paper and garnet abrasive cloth are therefore not hit-and-miss products so often misnamed "sandpaper," but are modern abrasive tools of highest quality.

Another steam shovel at North River, being used to help construct a dam to impound the waste mill water. The quarry may be seen in the background

Gold Veins of Sundry Areas in the Idaho Batholith*

Further Development of Elk City, Buffalo Hump, and Other Districts Warranted

By Francis A. Thomson
Dean, School of Mines, University of Idaho

THE IDAHO BATHOLITH is probably one of the best-known geologic features of the Pacific Northwest. It is also the most significant single geologic factor of the state in which it lies. Indeed, after six years of observation, I feel safe in venturing the generalization that the ore deposits of the State of Idaho constitute a metalliferous province ranged about this batholith, and having the batholith as its center and genetic agency.

Buffalo Hump from the southeast

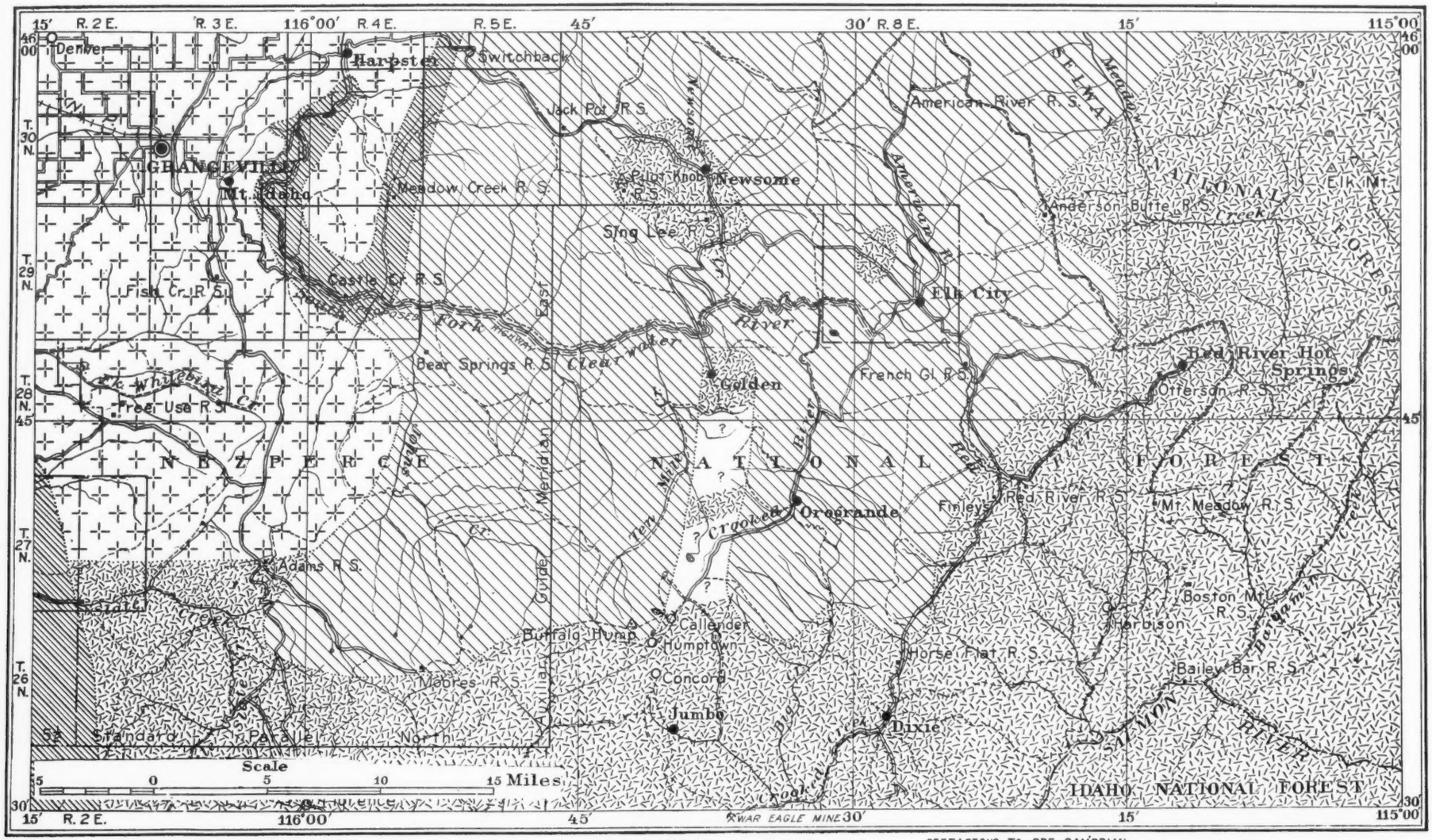
The "Hump" rises as a gaunt ridge or hogback to an elevation of 8,900 ft. It is visible from almost every point in Central Idaho

The silver-lead-zinc deposits of the Belt sediments in the Coeur d'Alene and adjoining areas to the north are generally recognized as being related to monzonite intrusions, which are almost certainly derived from the batholith. The copper deposits of the Seven Devils are closely associated with granodiorite invasions which are evidently batholithic cupolas or offshoots. So also are the lead-zinc deposits of Wood River, as well as the copper and lead deposits of Mackay, in Custer County, and of Leadore, Gilmore, and Salmon City, in Lemhi County. A glance at the map of the batholith will show its relationship to these, the principal base-metal producing areas of Idaho. The relationship of the precious-metal deposits is even more obvious, for not only do the gold-silver veins of Silver City, in Owyhee County, occur in granite and pass from it into overlying rhyolite and basalt, but from gold veins in the batholith and in its roof were derived the placers of Boise Basin, in south-central Idaho, and of Elk City, Florence, Pierce City, and other camps of north-central Idaho, all of which were so abundantly productive in the 60's and 70's. In fact, I do not know of an ore deposit in the state—and I think I have visited practically all the significant ones—which does not give valid evidence of batholithic derivation, in the ultimate sense.

The general geology of the area is comparatively simple, as shown by the ideal east-west section shown herewith. In noting the geologic column shown by the section it must be borne in mind that exposures of one or more members of the stratigraphic series often may be lacking, and that the outer members may, in places, be entirely covered by lava. In some marginal localities, the lava was noted in contact with the granite, in such attitude as to indicate that the old erosion surface of the batholith extends beneath the lava flow.

Economically, that country lying immediately along and outside of the contact of the central granite batholith with the metamorphic and overlying sedimentary rocks has proven to be the most important. This holds true, also, for that country well within the area of the batholith, where erosion has not removed the overlying rocks. The principal mines of the country are along these marginal or peripheral belts, and the roof of

*For simplicity, no references or acknowledgments are given in this article. Full bibliography, with references and acknowledgments will be found in the recently issued Bulletin 7 of the Idaho Bureau of Mines and Geology, in which the subject is treated at length.



EXPLANATION

MIOCENE — Columbia River basalt

CRETACEOUS — Granite and granodiorite batholith

JURASSIC-TRIASSIC (?) — Greenstone with limestone and other sediments

CRETACEOUS TO PRE-CAMBRIAN — Undifferentiated gneiss, gneissoidal granite, injection gneiss, quartzite, and mica schist *(Frequently eroded in small areas down to the underlying granite batholith)*

Compiled at Moscow, 1924 from U.S Forest Service and other surveys

Geology based upon Lindgren U.S.G.S. supplemented by observations of Thomson, Ballard, and Livingston of the Idaho Bureau.

Geologic Map of North-Central Idaho

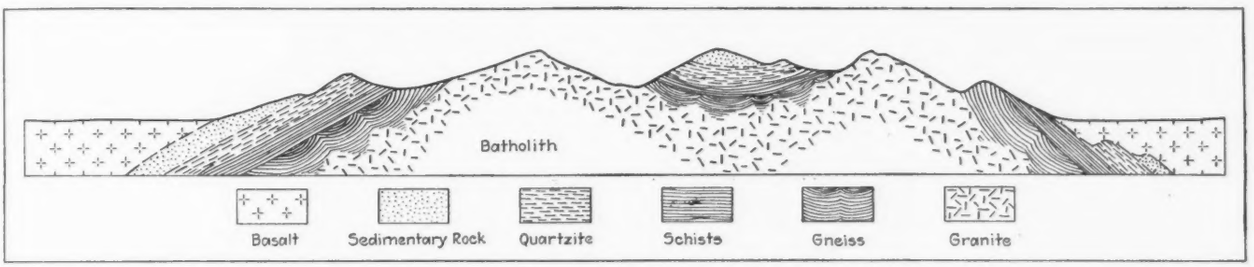
invaded metamorphic rocks overlying the batholith has proved to be the most favorable place for the development of the big gold-bearing quartz veins of the region.

The rocks of the mining districts are essentially of two kinds, metamorphic and igneous; in other words, invaded roof rocks and invading batholith rocks. Sedimentary rocks cover an insignificant area around the border region of the invading batholith and are not dealt with herein. No unaltered rocks of this type were found anywhere in the vicinity of the mines.

The invaded metamorphic rocks forming the shell, or roof, and the cover of the batholith are, in order, from the bottom upward, gneiss, schist, and quartzite. They present few features of special interest or significance.

The invading batholith with its derivatives and differentiates forms the most interesting geologic feature of the area. The various facies are for convenience divided into two groups, the acid or oxyphyric and the basic or lamprophyric. The acid group includes granite, quartz monzonite, granodiorite, and diorite in masses, with aplite, pegmatite, and rhyolite in dike occurrences.

The basic complementaries, obviously later than most of the acid rocks, are present in numerous dikes of a general lamprophyric type, which often bears a close resemblance to diabase, although its true diabasic character is doubted. Some unusual lamprophyre and diorite porphyries were noted in which the feldspar (and quartz) phenocrysts appear to have been crystallized deep within the magma, and removed therefrom with the porphyries during their extrusion.



Ideal east-west section through Central Idaho batholith

Gold Veins Associated With Dikes

The dikes of pegmatite, aplite, and lamprophyre appear to bear a close relationship to the gold veins in almost every instance. Cases are to be observed where aplite, pegmatite, and quartz veins grade one into the other. One specimen of quartz was found in a vein at the War Eagle mine, on Salmon River, wherein the pegmatitic phase was well developed, as evidenced by the presence of platy mica. Closely intergrown were copper sulphides and pyrite. Where observed in gradational phases, the pegmatite seemed to be intermediate between quartz and aplite.

In the Wild Rose mine, at Pierce City, occurs a typical pegmatite dike, consisting of unusually regular and uniformily sized crystals of pink orthoclase, white quartz, and muscovite, each from ½ to ¾ in. in diameter. This dike is intersected by a tunnel at a point 150 ft. below the surface, and at this depth assays consistently from $2 to $4 in gold.

The various dikes and sills emanating from the batholith extensively intrude the complex gneissoidal shell, and, to a lesser degree, the schists above. Aplite and small pegmatite dikes occur sparingly in the granite area around Florence, a region several miles distant from the surrounding metamorphic belt, and at an estimated distance of several hundred feet beneath the original roof of the batholith. The pegmatite dikes at War Eagle, still deeper within the batholith, are also few and small.

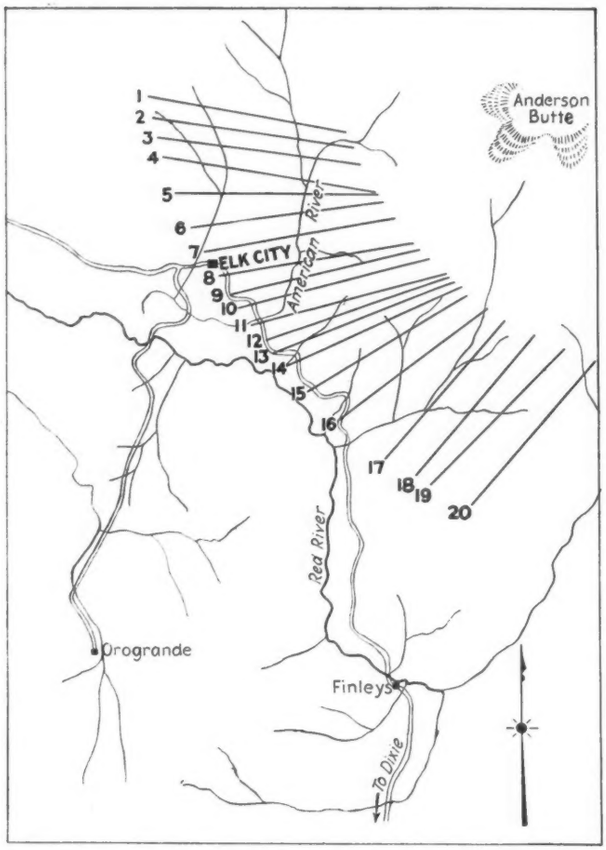
By far the largest and most important dikes are those of aplite. These are exposed locally as approximately parallel outcrops generally a few hundred feet apart, extending across the country in wide belts. The big quartz veins of the country are found best developed in the gneissoidal shell and in the lower zone of the schists and are intimately associated with the aplite dikes. Their almost constant occurrence in this association points strongly to a genetic relationship to the aplite. The quartz veins are found generally on one or both contacts of these dikes with the country rock. One instance was noted on Crooked River, about one mile above its junction with the Clearwater, where a large quartz vein outcropped in the schist. A few hundred feet away was found the outcrop of a big aplite dike running approximately parallel to the vein. No other igneous rocks were observed in the vicinity.

One point worthy of mention in the discussion of dikes is the occurrence of the "diabase" (lamprophyre). This can readily be identified in the field by its usually fine-grained texture, dark color, and extreme hardness in the unaltered specimen. Some outcrops have been altered by weathering, and the dark-colored minerals have been leached out, leaving the rock either light gray or light green in color. This rock is valueless as an ore, and for this reason any suggestion of a genetic relationship with ore disposition may seem to be too controversial. With the view of proving or disproving such a relationship, the following field associations are mentioned. Subsequent investigation may add important data: Many big quartz veins of central Idaho, generally described as "bull" quartz, are either barren of gold or so low grade as to be valueless under present conditions; but, where shattered and sheared, these veins become more or less productive. The metallic minerals therein are usually younger than the quartz and genetically associated with its fracturing. At or near most of the chief centers of local production, either with the veins or near by, usually with erratic strike and dip, occur these "diabase" dikes. The relationship is vague, but the almost universal presence of these dikes somewhere in the immediate vicinity of the chief ore deposits of the region appears decidedly significant.

The principal ore deposits of the country are steeply dipping fissure veins carrying principally gold and silver in a quartz gangue. The inclosing wall rocks do not seem to have had any chemical relation to deposition, though they may have been the source of the

manganese in the disseminated deposits of the oxidized zone, which are common to most of the region.

The ores of the entire region consist primarily of auriferous pyrite disseminated irregularly in a quartz gangue. In places galena, chalcopyrite, bornite, and sphalerite are associated with the pyrite. Siderite is associated with the silver minerals in some of the veins, together with comparatively minor amounts of gold. S. P. Jellum reports arsenopyrite in the ores of Pierce



Sketch map of Elk City district

1. Mineral Zone.
2. Larsen.
3. Allamance.
4. Major.
5. Buster
6. Columbia.
7. Wild Rose.
8. Del Rio.
9. Del Rio No. 2.
10. Medina.
11. Black Pine.
12. Hope.
13. Grant.
14. Blue Ribbon.
15. United Verde.
16. Triune.
17. American Eagle.
18. Uncle Sam.
19. Union.
20. Alberta Hercules.

City, and some was found at the Grangeville mine, a few miles south of Elk City. Antimony (stibnite) was observed in some of the ores of the country between Elk City and Orogrande. Native gold and, occasionally, native silver are to be found in the oxidized zones of the entire region. Tellurides are frequently reported, but only in three instances was any telluride mineral found, and that in negligible amounts.[1]

Covellite, Bornite, and Limonite Sometimes Found

The oxidation and intermediate products of the various ore minerals are of course common. Covellite and bornite are found in the intermediate zone, between "wind and water," as the sailors say. In some specimens the pyrite is naturally replaced by limonite. In one specimen, which contained also some covellite, the pyrite had been completely altered, and free gold in irregular shapes was left.[2]

Silver, in varying amounts, commonly accompanies the gold and sometimes constitutes the main value of the ore. The presence of galena in many of the higher-grade unoxidized ores is noteworthy. At no place visited were any of the metals, other than silver and gold, found in sufficient quantity to be of present commercial value. The higher-grade ore apparently occurs in shoots without definite boundaries.

The quartz of the oreshoots is coarse-textured and clear or white. It is usually massive, but in places shows some tendency toward comb structure. The mineralization is bunchy throughout the quartz, and irregularly spaced. Pyrite is the most prominent and persistent of the sulphides, but the others, one or all, occur here and there. Chalcopyrite, galena, and sphalerite, although nearly everywhere present in the ore, occur mainly as scattered crystals. These are sometimes to be seen as a bluish discoloration of the quartz, which, upon examination with a strong lens, proves to be an intermixture of minute crystals of the above-mentioned sulphides with quartz.

The oxidized ore of the country is free milling, but the sulphide ore is rarely so. The gold and silver content sometimes seems to vary directly with the amount of galena, chalcopyrite, and sphalerite in the ore, but at most places pyrite is the main auriferous sulphide. A segregation assay was made by J. H. Jonte of a representative sample of high-grade ore from the Concord mine, at Buffalo Hump, which was chosen because of the well-developed and typical sulphide occurrence.

Segregation Assay of High-Grade Ore from Concord Mine

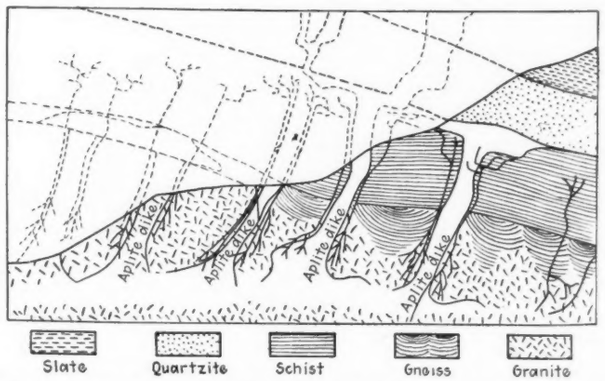
Material	Gold, Oz. per Ton	Silver, Oz. per Ton
General sample	2.38	5.2
Segregated pyrite	22.40	14.6
Segregated galena	10.50	67.1
Segregated sphalerite	5.60	80.8
Segregated quartz	Trace	None

Production from Oxidized Zone

Some few bonanzas have been found in the past, usually limited to the oxidized zone of the veins. However, decided exceptions to this occur in several of the mines of the district; at such places high-grade ore occurs entirely within the sulphide zone. In the vicinity of the veins, large bodies of low-grade, oxidized ore—the so-called "dike deposits"—are found

[1]There is much loose talk of "tellurium ore" and samples of auriferous galena were frequently presented as gold telluride. The fact that a gold-bearing mineral "sweats" gold when roasted proves that gold is present; it of course proves nothing with respect to tellurium.

[2]This latter phenomenon I have noted elsewhere. Is it not possible that in the progressive oxidation of auriferous pyrite a migration of the disseminated gold therein takes place, just as the copper at Rio Tinto migrates in "kernel" roasting?



Hypothetical section showing relation of a vein system to the roof of a batholith and existing topography

with the gold widely disseminated throughout the much altered inclosing country rocks: gneiss, schist, granite, and aplite.

Numerous mills were built in the past to treat the ore found in the oxidized zone, but when the sulphide ore was reached, operations practically ceased for the reason that amalgamation was relied upon as the principal process of recovery.

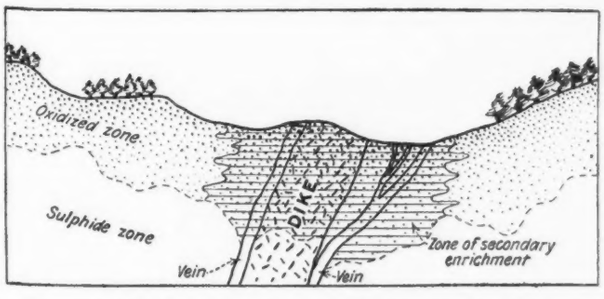
Likelihood of Persistence at Depth

The assay maps which are available give some information as to the probable depth of the primary ore. Comparison was made of the ores of the quartz veins occurring in the schists several hundred feet above the roof of the batholith at Elk City, with those occurring near the roof at Buffalo Hump and with those of the War Eagle mine and vicinity, more than 2,000 ft. below the roof. Throughout this vertical range there is a consistent precious-metal content which seems to warrant the statement that commercial bodies of ore will persist with depth.

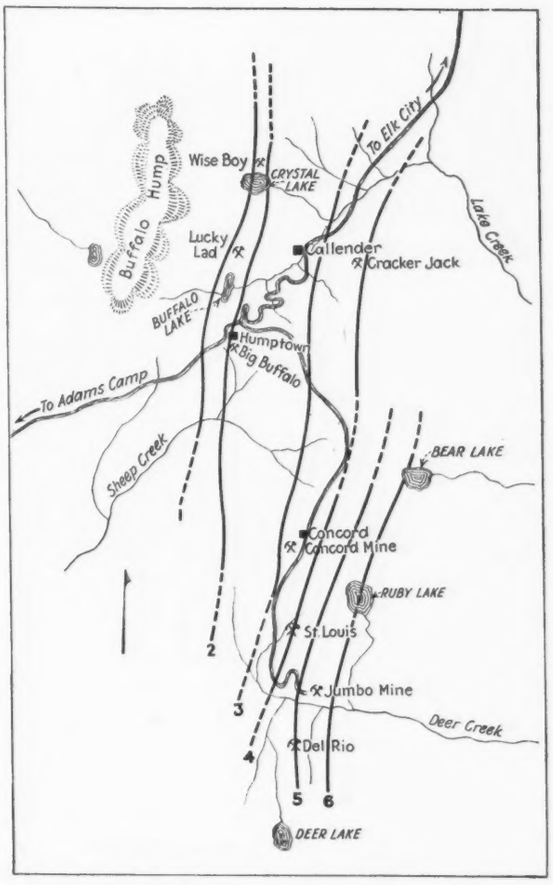
Numerous specimens of fresh sulphide ore were collected at various mines throughout the district in 1923. Detailed laboratory examination of these was made, and these investigations definitely prove the primary character of the unaltered auriferous pyrite and galena. The gold and silver associated with these may reasonably be expected to persist with depth; to what extent they persist must obviously be proved by development. In this connection it is well to call attention to the fact that some low-grade sulphide deposits will not pay in themselves except throughout the upper oxidized zones where enrichment has occurred; or, in other words, rich oxidized deposits will not necessarily lead down to rich sulphides. However, the deposits in certain areas still on the border land between the zones of oxidation and of sulphide minerals warrant prospecting for primary ore.

As previously stated, the quartz veins of the country show two periods of formation. The more massive white variety, locally called "bull" quartz, is, mainly, a dense vitreous aggregate of interlocking crystals sparsely studded with metallic sulphides. It was first to form and it constitutes most of the vein. A subsequent phase, best known among the miners as "vein" quartz, formed as irregular segregations and lenses in the main quartz vein, with veinlets branching out both into the original quartz and into the inclosing wall rock. Though both varieties carry gold and silver, the so-called vein quartz evidently forms the higher-grade ore.

As the quartz veins are undoubtedly related to the granite batholith which formed during the late



Hypothetical cross-section of dike deposit showing spreading of gold above the water level

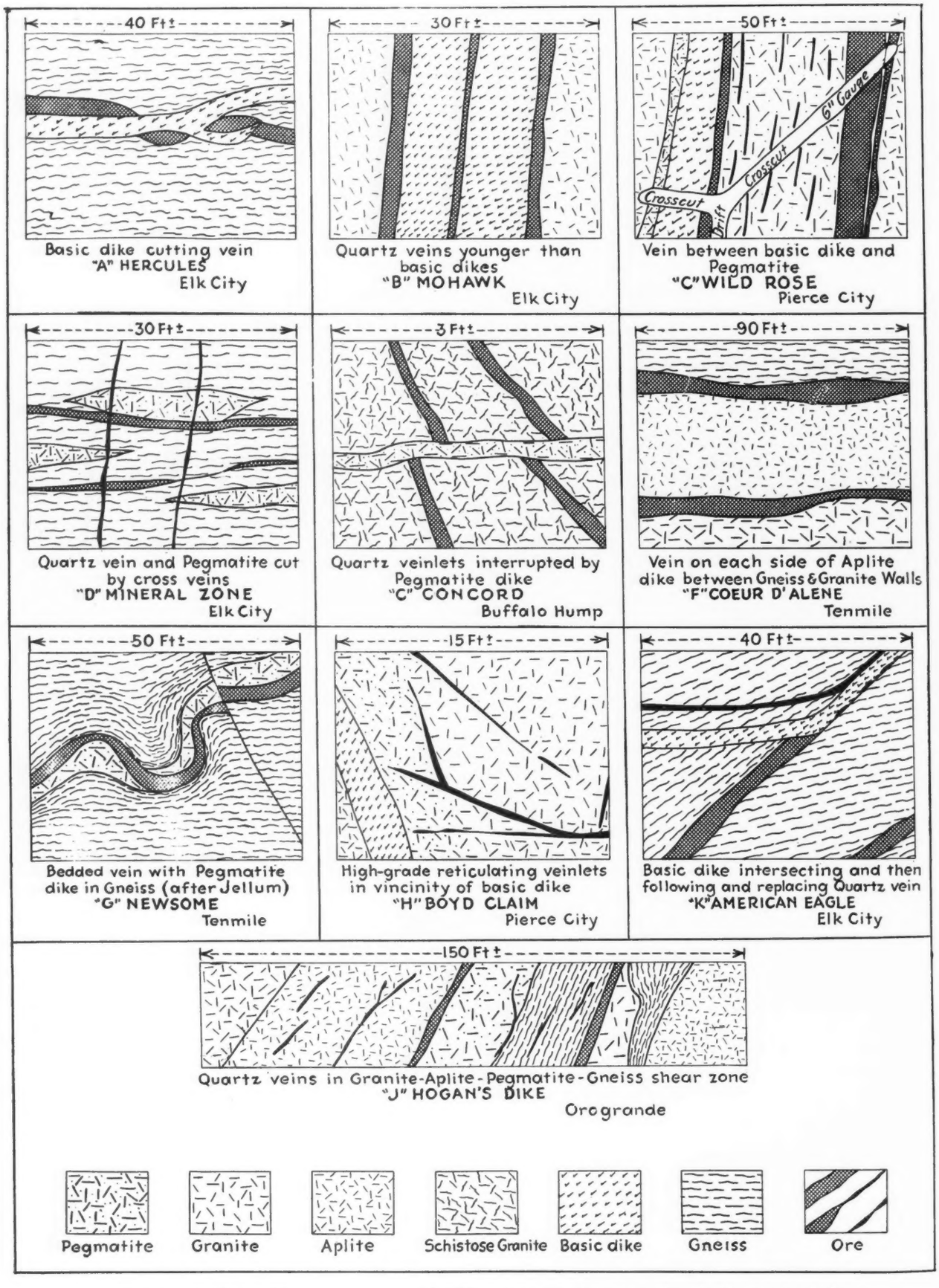


Vein system of Buffalo Hump district

1. Wise Boy. 2. Big Buffalo. 3. Mother Lode. 4. San Francisco. 5. Jumbo. 6. Spokane.

Cretaceous or early Eocene period, they can best be placed as early Tertiary in age.

The strike of the veins is usually similar for a particular locality, though cross-veining occurs at some places. Seldom do the parallel veins of any locality dip in opposite directions. The dip of the Big Buffalo vein, at Buffalo Hump, is one of the exceptional cases. The width of the veins varies from a few inches to 60-ft. They attain their greatest average width for any one locality at Buffalo Hump, the veins here being generally between 10 and 20 ft. wide. As a rule, the ore occurs in steeply pitching shoots, often of considerable longitudinal extent. The dip and pitch of all oreshoots, explored in the past, according to stope maps, were such that ores could be handled underground by gravity. The only exception to this is the type of vein found in the vicinity of the South Fork and New York mines, in the Tenmile district, a few miles south of Newsome. Here, the country rock is a much folded and contorted gneiss intruded by pegmatite sills following the schistosity of the gneiss. The quartz veins in the vicinity of the intrusions occur roughly parallel to the schistose structure. It is highly probable that this type of folded vein is much older than the other more common steep-dipping variety which cuts through the gneiss and schist without regard to the folding therein. At the New York mine one sees an excellent development of this type of quartz vein. From 3 to 10 ft. it folds and doubles back on itself in a very perplexing manner. A considerable tonnage of good ore came from the oxidized zone of this vein.



Types of Vein Occurrences and Dike Associations in North-Central Idaho

Faulting is nowhere a serious handicap in following the ore. The horizontal striæ on the walls of some of the veins are the most evident clew to the main displacement which occurs. Two prominent flat-dipping faults occur in the Buster mine, at Elk City. There is a common report, locally current, to the effect that the lower of these caused such serious displacement of the vein that the character of the ore above it did not, at that time, justify the expense necessarily involved in locating its downward extension. Later authentic information is to the effect that the ore ceased to pay at a point 15 to 20 ft. above this fault. This is a more significant statement.

The two most interesting vein systems of the area are those of Buffalo Hump and of Elk City. The Buffalo Hump system comprises a series of north-and-south veins of practically parallel dip and of rather remarkable persistence. The basic dikes previously discussed are conspicuously present in practically all of the accessible workings.

Buffalo Hump diggings

The Elk City system is similar in the relationship of quartz veins to near-by parallel aplite dikes and to the presence in most instances of the basic dikes. It differs in that the vein system is fanlike. The veins here are more numerous than in any other like district examined. Practically all of them occur in the gneiss, although some extend upward into the schist. The granite crops out at a number of places and is clearly never far below the surface.

Origin of the "Dike" Deposits

An important phase of the ore deposition was evidently overlooked or disregarded by the pioneer miners. An understanding of the relation which secondary enrichment bears to a particular property is necessary for a successful solution of mining and metallurgical problems involved. Though this phase of deposition was not in evidence at all places visited, it was decidedly so at most of them.

Throughout the country rock of the oxidized zone, in the vicinity of ore-bearing quartz veins, is sometimes found a wide dissemination constituting a low-grade gold ore, assaying from a few hundredths to several tenths of an ounce to the ton. Such mineralized zones generally extend from 150 to 200 ft. in depth, and often 100 ft. or more laterally on one or both sides of the vein, depending upon the permeability of the inclosing rock. The descending acid solutions greatly alter the invaded rock. It is generally so decomposed that very little powder is needed to break it; in fact, much of it is what the miners call "picking ground."

Stains and deposits of iron and manganese are everywhere evident in fissures and on cleavage planes of the rock around the margins of the old stopes. The dark dendritic manganese stains stand out prominently on some of the lighter-colored rocks. Throughout such oxidized zones, low-grade gold values are everywhere associated with the manganese occurrence—not necessarily mixed with it, but in the same vicinity.

Past work has clearly shown that the disseminated deposits cease rather abruptly at the bottom limit of oxidation and that, thereafter, the values are confined to, or closely associated with, the quartz and sulphides of the fissure veins. Of such a nature are most of the so-called dike deposits of the district. The Butte and Orogrande, or Hogan mine, at Orogrande, is the best developed orebody of this type, and from it 100,000 tons of ore said to average $3 per ton have been milled.

Zones of Narrow Quartz Veins

In some of these mineralized areas no large quartz vein is evident; instead, there will be found a comparatively narrow zone of small quartz veins and branching stringers cutting through the country rock. These veinlets often carry considerable gold, but the low-grade "ore," referred to above, is to be found in the altered country rock away and apart from the quartz veins. The absence of such dissemination in the sulphide zone is the deciding factor.

One place visited showed another phase of the enrichment process wherein the enrichment was confined almost entirely to a 4-ft. vein and did not appreciably affect the inclosing country rock. Here, the oreshoot is highly stained with manganese oxides and extends upward to within a few feet of the surface and for 160 ft. along the drift. The ore averaged close to $85 per ton and "plated" between $55 and $60. The rich ore was bottomed at 15 ft. below the creek level. A 110-ft. shaft, sunk to explore the vein at depth, disclosed values in the sulphide zone ranging between $6 and $10 per ton.

Future Prospects of the Area

The lack of suitable highways is such that, under existing transportation conditions, only placer mining and the working of bonanza gold veins could be expected

American Hill diggings

to show a profit. The outstanding question regarding the area is therefore, "Can lode mining be conducted at a profit when motor-truck highways become available?" The answer to this significant and indeed crucial question depends upon three major factors: (1) The size and persistence of the veins; (2) the gold content of the veins and its longitudinal distribution therein; and (3) the depth to which a workable gold content may be expected to continue. Each of these will be discussed in order.

(1) The Size and Persistence of the Veins—In the various districts which have been mentioned the following observations have been made on this point:

Width and Length of Gold-Bearing Veins

District	Number of Veins Examined	Average Width, ft.	Length Along Outcrop, ft.
Buffalo Hump	10	4 to 16	1,000 to 6,000
Orogrande	7	2 to 5	1,000 to 7,000
Elk City	10	2 to 7	500 to 3,000
Tenmile	6	2 to 6	500 to 2,500
Dixie	5	1 to 5	500 to 1,500
Pierce	5	2 to 10	500 to 2,500

Such veins compare favorably, so far as size is concerned, with the gold veins of Australia, California, and Cripple Creek. The so-called "dike" deposits are purposely omitted from the tabulation given above.

It is axiomatic that a certain relationship exists between length along the strike of a vein and its persistence on the dip, and such being the case it is apparent that the gold veins of central Idaho cannot be classed as "gash" veins lacking depth.

(2) The Gold Content of the Veins and Its Longitudinal Distribution Therein—It was clearly beyond the scope of the present investigation to attempt any systematic sampling of the numerous veins examined, even were such a course possible in the face of the well-known difficulty of sampling orebodies containing free gold. Mill returns afford perhaps the best criteria, and the following figures are presented as bearing on this point:

Mill Returns From Gold Ores

Plant	Total Tons Milled	Probable Average Value per Ton
Jumbo	75,000	$5.00
Big Buffalo	20,000	17.00
Cracker Jack	10,000	5.00
Badger	1,600	7.00
Orogrande	100,000	3.00
Buster	22,000	15.00
American Eagle	10,000(?)	15.00
South Fork	10,000	12.00(?)

The question of the longitudinal distribution of the gold content is still an open one. Surface enrichment has been so important a factor in, and for a slight distance below, the oxidized zone, as to obscure the localization of the gold content in primary oreshoots, except in those few properties where development has been sufficiently extensive to get below the permanent water level.

Nevertheless, the Jumbo and the Big Buffalo mines afford indubitable evidence of such localizations; so also do the War Eagle and the American Eagle mines. That such shoots may be connected with cross fissuring appears probable. Some of the former operators in Buffalo Hump, where the greatest development has been done, thought that the shoots were too far apart to make profitable working possible, but it appears to me that any definite conclusion on this point is beyond the limits of present knowledge. A negative answer is not warranted.

(3) The Depth to Which a Workable Gold Content May Be Expected to Continue—The dread spectre of superficial richness has certainly done as much as lack of transportation to delay the development of the gold field of north-central Idaho. Indeed, it has doubtless contributed to the apathy which has so long delayed the needed transportation. It is to be admitted that the cost would be considerable, so that inaction in this respect is quite understandable.

The issuance of the report mentioned has been delayed, so that there might be ventured at least a qualified "laying of the ghost," and the conclusion is reached that although surficial enrichment has played an important part in the region and must be kept well in mind in all future developments, there are nevertheless excellent reasons for believing that primary ore of workable grade persists in at least certain parts of the area to depths far below that attained by present workings.

I have been especially impressed by the small amount of development work in proportion to the surface evidences of persistent mineralization, and I feel no hesitation in saying that in many of the districts herein described, much greater boldness in development than has yet been shown is abundantly justified in light of the essential facts.

Discussion

"Engineering and Mining Journal-Press" is not responsible for statements or opinions published under "Discussion." In many cases the views expressed are diametrically opposed to editorial policy and belief.

Is Geology in the Doldrums?

THE EDITOR:

Sir—Is geological science in the doldrums? Is geology already entered far into a state of decadence, in these opening decades of the twentieth century? Does the microscope really displace the telescope in the philosophical prospect of the earth? We think not. We do not agree at all with President Lowell of Harvard, in his recent assertion that for many years geology has taken no step forward. We shall have none of his Blue Imps.

In somewhat similar lament the editor views only applied science; and the professor in Arkansas his college. We believe that it is the miscroscope which, instead of shutting out the world view, is opening to us the myriad vistas of new universes. We know what the editor does not know. How little does he appreciate the fact that had it not been for his very superior early training with the microscope and his later and long skillful use of it, the world's masterpiece on ore deposits, "The Ore Magmas," would never have seen the light of day.

The names with which we are accustomed to conjure in our generation are names of personages viewed at a distance. Men grow tall with the passing years, when the multitudes about them fall away. Hugh Miller, Lyell, and Murchison, Dana, Dutton, Gilbert, and King, dazzle for the moment by their brilliant proposals, however insecure are the foundations. Not one of these men leaves behind him a substantial great thought by which his name will for long be remembered.

Even in our day every one of their startling assumptions already begins to crumble under the later test of quantitative measurement and microscopic examination. Their hypotheses, brilliant though they seem to be, are of the same evanescent and unsupported order as the poet Goethe's fantastic dream of the origin of the human skull by coalescence of end vertebræ, and as René Des Cartes' many philosophic guessings of four centuries ago.

The modern reader of Lyell, is, as Professor Watts so pointedly observes, continually haunted by the feeling that the author was somehow struggling for a single missing generalization which he failed to find. Lyell leads up again and again to the missing conception, and though the facts and inferences which he marshalled can now be seen to be marching on the great idea of evolution, he never quite succeeded in attaining it for himself. This is reserved for Darwin, the biologist.

Of all the blazing galaxy of novel concepts originating on our Western deserts only Powell's base-level of erosion remains an accepted doctrine. And the curious circumstance associated with it is the fact that, conceived in an excessively dry region, it is severely applicable only to pluvial climate conditions, and in the land of its birth not a single characteristic of it is either present or even feebly represented.

It is true that there were giants in the good old days. Fifty years or a century hence there will be giants of our day; more of them, more towering, huger in proportions. The new earth concepts which our generation sends forth surpass anything which has gone before. They are composed of sterner stuff than any which made the giants of other days. They mark forward strides far beyond those of any other century or period.

As brilliant discussions as any ever held are those of Davis and Daly, of Harvard; of Lawson, of California; of Chamberlin, of Chicago; of Reid and Berry, of Johns Hopkins; of Taylor, of Fort Wayne; and of a dozen of other American geologists, to say nothing of Suess, and Geikie, and Wagner, and Federow, and Margerie, and a score of other Europeans. They excel anything in geological circles that appears in the past. A century hence these men, too, will tower above the vanishing mob, as now do Lyell, Murchison, and Ramsey, of the last century.

Reference of the cause of the complex glacial epochs to the varying eccentricity of the earth's orbit is a far more subtile thought than mere recognition of the existence of a single Ice Age by Agassiz. Resolution of the metamorphosed Pre-Cambrian complex into an orderly stratal arrangement involving two great eras of time, each of which is the equivalent of all time which has elapsed since, is a far more wonderful performance than anything which Murchison devised. Idea of peneplanation of earth's surface is many times more brilliant reasoning than Ramsey's hypothesis of marine denudation. Deflation of the deserts down indefinitely below sea level, provided the waters of the sea are kept out, finds no counterpart in musings of past generations.

The magnificent services of monographs of Wachsmuth and Springer on the ancient crinoids vastly exceeds the fondest expectations of palæontologists of bygone times. And the year-old monograph of New York's Devonic echinoderms by a demure Miss, Winifred Goldring, greatly excels any effort of that prolific giant of other days, James Hall, mere mention of whose name recalls the entire panorama of American geology. There are a hundred great world-thoughts belonging to the last quarter of a century where there was one in former generations. There is a race of intellectual giants in geology where only one towered before. In a crowd of giants the impress of unusual size is lost to the onlooker.

The main semblance to geology in the doldrums is only in the field of applied science, where the pure science enters the industries. Even there it is really more apparent than real, because of mediocre minds that naturally swarm to such field. The lion in the

sheepfold is lost to view. Yet even in so prosaic a province as economic geology centenarians will hark back to the giants of today, to Orton and the oil, to Winchell and the secondary enrichment of orebodies, to the strategists in the great World War, where victory perched upon geological rather than military lines. There are scores of gigantic thoughts on earth science let loose during the last decade the creators' names of which will long outlast their century.

In marked contract to the pessimistic view regarding the status of geology is the more pleasing prospect of the much maligned Bolshevik, who, more fortunately situated, is unhampered by any excessive reverence for ancestral proprieties, and, anticipating the unmistakable trend of modern civilization, is able to reconstruct a great nation upon lines unbent by long established custom, by grouping all citizens into thirty-five separate castes, each carefully ranked according to the value and ability for service of its members to the State. In this ranking process the geologist is given precedence over all others and is placed first and at the top; and the generals of the armies, who, from time immemorial, have always rudely elbowed all other citizens aside, are given last and lowest post.

If we are to view geological science only in the cloistered hall, then it is most assuredly in the doldrums. But all advancement in the sciences is not locked up in the universities, or fostered by them. Not only this, but most advancement in science goes on outside of college walls, despite the latter's supposedly superior afflatus. Craving for the melodrama is not confined to the mob. Scientific progress is not always accompanied by flare of pyrotechnics.

Geology is not in the doldrums, but far within the trades. CHARLES KEYES.

Des Moines, Iowa.

"Forgotten Stockholders"

THE EDITOR:

Sir—Under the above-quoted title the editor of the *Journal-Press* strikes at the very root of the present difficulties which confront the mining enterprises in their efforts to finance the development and exploitation of mines of all descriptions. The situation has been brought about by degrees; by assumption of boards of control, or directors, where such action suited their ends. The success of such action, in a conspicuous instance wherein the board members showed conscientious interest in the stockholders, has been pointed to by the less scrupulous in broadcasting advertisements of large consolidations and capitalizations. Several such stocks have been widely scattered, in small units, and, as peculiar to such stocks, bartered in and battered up and down on exchange and curb, with constantly shifting ownership, until there cannot be that personal interest of the stockholders in the annual meetings, or, as intimated in the editorial, any particular interest in what kind of a report is sent out.

Having intentionally, if we care to give them credit for so much foresight—otherwise accidentally—attained the disinterest of the stockholders, the way is paved for the next step, the one which, based on the root evil, is substantial ground for the disrepute in which mining as well as some other industrial stocks are held. This is the alienation of the property, its resources, goodwill, and future prospects utterly beyond redemption by its owners—the stockholders. This is accomplished by the meeting of a few—three or four—interested stockholders, who hold the proxies of the thousand or so, disinterested (and some possibly deeply interested) stockholders, who vote to mortgage away all their (the stockholders') right, title, and interest in and to the mine, its equipment, and appurtenances, by way of protection of bonds, the latter to draw guaranteed interest. In the case of mining, this is too often carried to the limit, considering the nature of the "wasting resources" as affecting the owner-stockholder, but nicely calculated to return the investment and interest to the accommodating bondholders during the anticipated life of the enterprise. How often do these bondholders, these "saviors" of the company, represent the few controlling stockholders?

Fortunately, as pointed out in the editorial, there are respectable boards of directors, men like W. Mont Ferry and others who mine for the sake of mining the ore, not the public. Glance over the list of successful mining companies—those companies which are paying dividends to their stockholders commensurate with the risk the latter accepted in buying, developing, and equipping the property: how many will one find that is burdened with "bonded indebtedness"? How many such stocks are "trading stocks"? The public, with the "trading stocks" constantly before it, in market reports and eternally circularized and advertised, has little appreciation of the meritorious, stock-dividend earning capabilities of mine-managed mines vs. the "financially" managed mines.

The remedy lies in publicity of such methods and unstinted condemnation of the "financial" methods practiced, in the education of stockholders to a standard of direct, personal interest in the mine and in its operation, and, last but not least, in the personnel of the board of directors to whom the stockholders entrust the businesslike handling of the affairs of the company in which they share.

The mining enterprise which is bonded to an extent that would in the case of industrials, railways, or farming be the "limit," is a failure as a mining enterprise and the company whose stock is broadly held, which submits "indecipherable accounts" in lieu of a report, is justifiably open to suspicion as well as censure.

Another aspect, as affecting stockholders in copper mines, is observed in the attitude of some of the producers of the much-touted foreign "cheap copper," which is giving domestic producers a bad hour over consideration of the heavy investments in property, plants, and equipment. Is the (generally) mortgaged, foreign producer to continue the practice of selling his copper on a basis which only takes care of the interest on the bonds to the exclusion of, and forgetting the rights of, the stockholders, or is he going to recognize, or are his stockholders to force him to recognize, the stockholders' rights on their investment, and put his copper on the market at such price as will afford a reasonable return (as truly a part of the cost of production as labor, explosives, and all other factors) on the money which the stockholders have put into the enterprise to bring it to its "mortgagable" value?

The stockholder, if any one, has the first right to this. The fact that he has no "guaranteed interest" on his stock does not justify any management in selling his—the stockholder's—copper without giving due considera-

tion to this cost factor and providing for the unguaranteed, morally obligated interest due the investor who gave the enterprise its "mortgagable value."

This aspect applies equally to South American and South African producers. Arthur Notman, in his article, "The Bogey of Cheap South American Copper," has presented some convincing figures which should be brought home to every stockholder in these companies, who, in turn, should exercise his prerogative in dictating the policy of the management.

The "we want the money—to hell with the stockholder" policy of too many operating companies has done more to discredit mining than all the wildcats put together. The remedy lies in education of stockholders through both technical and lay press and outspoken condemnation of the practice of financing the stockholder out of his ownership. L. S. ROPES.

Helena, Mont.

An Old-timer of the Comstock

THE EDITOR:

Sir—In looking over the *Mining Journal-Press* of April 26, 1924, I read an interesting account, by George Thomas Marye, Jr., of the early discovery of the Comstock Lode, telling by whom it was discovered and giving the names of the owners of the principal mines on the lode. One was called the Hale & Norcross mine. Mr. Hale for his interest got $600,000. He went to South America, got mixed up in an insurrection there, lost all and returned to the United States, came to southwestern Oklahoma in Comanche County, prospected in the Wichita Mountains and made a discovery of a seemingly good copper mine, but did not have the money to develop it. He stayed with the prospect for several years, went blind, and died in poverty in, I believe, 1912.

I knew Mr. Hale very well. He would talk occasionally of the Hale & Norcross mine, on the Comstock Lode, but was rather reticent in talking about his past life.

If this information is of interest to you in regard to old-timers of olden days I feel glad to furnish it. And, by the way, the Hale mine in the Wichitas, although an exceptionally good prospect, is still undeveloped. D. FITZGERALD.

Lawton, Okla.

The American Association of Engineers

THE EDITOR:

Sir—In your issue of Sept. 6 is an article by Mr. A. T. Roos on "An American Union of Technologists." Most engineers will agree with him that the profession is underpaid and that the remedy is organization, but very few will be willing to accept the method he proposes.

Engineering is a profession fully equal to that of law or medicine, and not merely a trade such as plastering, bricklaying, or carpentry. Professional engineers should take no more kindly to the idea of forming a trade union than would lawyers or doctors, and a national organization of technologists should be able to do as much for their profession as similar organizations do for members of the legal and medical professions, without descending to the level of the trade union.

In fact, such an organization is already in existence, and for the express purpose of "promoting the social and economic welfare of the engineer." Membership is available to engineers of all branches of the profession, and the American Association of Engineers is today the largest engineering organization in this country, and the only one whose chief aim is the improvement of conditions for the profession as a whole, rather than technical discussion of a specialized branch. The latter is the chief function of the various technical societies such as the four Founder Societies and others. The association thus covers an entirely different field, and not only does not interfere in any way with these other technical societies, but urges its members to join the society which deals with their specialized branch of engineering.

In the legal and medical professions, a man must pass the bar examination or the state medical examination before being permitted to practice. By thus preventing, to a large extent, practice by incompetents or those with a mere smattering of knowledge, public confidence is established, and the standing of the entire profession is raised.

The American Association of Engineers believes that by similar methods the standing of the engineering profession can be advanced, and, with this purpose in view, the association is attempting to secure the passage of registration laws for engineers in every state in the Union. These laws are already in force in a number of states.

There has been some opposition to the idea of registration among the engineers themselves, particularly among the mining engineers. The opposition apparently has been based largely upon inconvenience caused engineers who may have a practice in several different states, and this objection is being overcome by attempting to make the laws uniform and to establish reciprocity, whereby an engineer licensed in one state may practice in any state. The association desires to secure the passage of the best registration laws possible, and will welcome constructive criticism, and it is suggested that all engineers would do well to co-operate for the purpose of obtaining a good law, rather than to oppose any license law whatever.

The aim of the American Association of Engineers is to raise the standing of engineering as a profession, and not to form a union, as is sometimes claimed. Thus we find that engineers are organized already, but in the proper way. The organization is functioning, and hence all engineers who realize the necessity of organizing need but join the existing organization and co-operate to raise the standing of the profession to the place it deserves. W. C. HOGOBOOM.

Los Angeles, Calif.

Keeping the Pot Boiling

THE EDITOR:

Sir—I am selling real estate here in order to make enough money to work at mining, and I don't agree with Mr. Maclennan in the *Mining Journal-Press* of Aug. 30, page 324, a little bit. Mining engineers in the mass have not some one to cable to in England to bring them back to prepare for a ready-made job, and there are a heap of mining engineers at present who are selling automobiles or something worse until mining staggers back or breaks its neck in trying to do so.

In the meantime, we thank those of you who are periodically sending forth gleams of a better day.

San Francisco, Calif. W. J. WOOLSEY.

News of the Week

The Mining News of ENGINEERING AND MINING JOURNAL-PRESS is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Summary

THE INVESTIGATION of every phase of the copper mining industry is promised by the Federal Tariff Commission, which has been directed to undertake the task as a consequence of agitation of the question by producers in Michigan.

Ontario's gold production of $11,810,060 for the first six months of 1924 is an increase of 36 per cent over the corresponding period of 1923.

Contracts have been let by the Shamrock Mines Co. for the erection of an 80-ton cyanide plant at Ione, Nev.

The recent dividend of $400,000 declared by the Premier Gold Mining Co. brings the total disbursements of the British Columbia bonanza to $6,050,000.

Development and shaft sinking feature operations in the Republic gold district, in Washington.

The Tonopah Extension company is making headway with its Diesel engine installation at Tonopah, Nev., to have an ultimate capacity of 6,000 hp.

A new company known as Placeres de Oro de Bacubirito y Michoacan will begin large-scale dredge operations in Mexico.

Calumet & Hecla operations are nearly normal, following the fire on the 57th level near the Red Jacket shaft.

A recent statement by Rhodesian Congo Border Concessions suggests a potential copper producer that may rival the Union Minière in South Africa.

Magnetic prospecting of its Corrigan ground in the Coeur d'Alene is the basis of new development by the Federal M. & S. Co.

New Company Will Dredge Gold Placers in Mexico

Large Concessions from Government—Dredge Will Start in Bacubirito District—Another Ordered

A company backed by Mexican and foreign capital, to be known as the Placeres de Oro de Bacubirito y Michoacan, has been formed for the purpose of working extensive gold placers in the states of Sinaloa and Michoacan, Mexico. A large part of the territory was recently explored by the Bethlehem Shipbuilding Corporation, of San Francisco, by the use of Keystone drills. Many valuable nuggets of gold are said to have been found, and large areas were shown to contain an average of from 30 to 50c. per cubic yard.

The company has acquired from the government possession of nearly 4,000 acres which are estimated to embrace many million cubic yards of gold-bearing ground.

The first work is to be carried on in the Bacubirito district, in the State of Sinaloa, where the company now has a dredge and other machinery with a capacity for handling 5,000 yd. per day. Another dredge is soon to arrive at the port of Mazatlan and will immediately be moved to the field and placed in operation. The dredges are of the type used in the California gold regions.

The principal gold placers in Mexico are situated in Lower California; in the Altar and Bacabachi districts, State of Sonora; Choix and Bacubirito, in the State of Sinaloa; Tigre district, Nayarit; Carrizal, and Arteaga, in Michoacan, and the region of Coyuca, in the State of Guerrero. All of these rich placers have been worked successfully by "gambusinos" washing by hand or other crude methods.

The new company will be the first to work with modern machinery and a well-organized plan of development and operation.

Premier Declares Another Quarterly Dividend of $400,000

THE Premier Gold Mining Co., operating in the Portland Canal district in British Columbia, has declared a dividend of $400,000, payable on Oct. 2, covering operations for the third quarter in the year. The company continues to operate at full capacity of mill and tramway. Total dividends to date are $6,050,000.

Gold Placer Strike in British Columbia

A new placer gold strike is reported to have been made at Eagle Creek, in the Cassiar district of British Columbia, and a party of twenty experienced miners recently left Wrangell, Alaska, fully equipped, to investigate the new discovery. Eagle Creek is about 250 miles northwest of Wrangell. Considerable gold has been mined in the general region, and the chances are said to be good.

Tamarack Reclamation Plant, in Michigan, Virtually Finished

But It Won't Be Started Now—No Increase in Calumet & Hecla Output Expected

The new Tamarack reclamation plant of Calumet & Hecla Consolidated is nearing completion. A channel is being built into the shore plant, and installation of equipment is in its final stages. The entire project will be completed, it is estimated, in eight weeks. It has not been decided, however, when the plant will go into operation. This is dependent on the metal market, and there is no demand in sight for additional production. The plant, working at capacity, will recover approximately 900,000 lb. of refined copper per month from the Tamarack conglomerate sands, or about half the capacity of the Calumet plant.

There is little prospect of any substantial increase in refined copper production by Calumet & Hecla Consolidated for some time. Though some of the other mines in the Michigan district are taking on more underground men, the needs of Calumet & Hecla are supplied in this respect. Only such men will be hired as are needed to keep the present organization together, and the five-day week operating plan will continue in force until there is need for a change.

Generally, the labor situation in the Michigan copper district has improved. Underground men are not plentiful, but less difficulty is being experienced in supplying the needs of the mines.

Federal M. & S. Co. Bases New Development on "Electric" Prospecting

The Swedish-American Prospecting Co. has completed its contract with the Federal Mining & Smelting Co. for prospecting the Corrigan ground in the Coeur d'Alene district, by the electrical process devised by Hans Lundberg and Harry Nathorst, of Sweden. The Corrigan ground has been the scene of quite extensive development many years ago, and it is believed that the problem of finding ore deposits has been solved by this new method of prospecting. At any rate it is understood that the Federal company will take up a new development program, based upon the conclusions reached through electrical tests which have occupied about two months.

The work on the Corrigan was done by Edward Husberg, mining engineer, and Erik Ygberg, geologist, both residents of Sweden. Both have had much experience in European countries, where the electrical process has been used successfully in numerous mining fields.

The work for the Federal company, the first to introduce electric prospecting in the Coeur d'Alene district, attracted much interest among mine operators, and it is understood that other companies are negotiating with the Swedish-American company.

Colorado Tungsten Properties Are Being Reopened Near Boulder

The Tungsten Production Co., Inc., has been organized to take over the holdings of the old company of somewhat similar name, and other properties, comprising in all an estate of several hundred acres of tungsten lands in the heart of the Boulder County tungsten district in Colorado.

The company has begun operations in the old tunnel which intersects the properties, and the workings are being cleaned out preparatory to production for the mill at the tunnel portal. It is thought that present prices for tungsten will justify the operation of the mines and mill, which have been idle since the close of the war.

Mosqueteros Mine, Neighbor of Ahumada, Has Rich Ore

A most interesting exhibition of ore from the property of the Mosqueteros Mining Co., in the Lamentos mining district of Chihuahua, Mexico, is being displayed at the International Fair in El Paso. This company, which was organized and developed by the same men who formed the Erupcion Mining Co., is in the same district as the Ahumada and Erupcion properties.

The Mosqueteros property is at present being worked under contract by the Peñoles Mining Co. of Mexico, one of the most active companies in Mexico, the ultimate object being to acquire control. Under the present management ore has been discovered in fairly large quantities and is being shipped from the Mosqueteros properties to the Torreon smelter of the Peñoles company.

Not Big But Sweet!

THE Great Western Mining Co., operating a small but rich gold property at Lincoln Hill, in the Rochester mining district, in Nevada, will pay a dividend of 1c. per share on Oct. 20.

This property is equipped with an auxiliary gasoline power plant, so that electric power shortage has not resulted in complete suspension of development. The mill is said to be turning out more than $500 per day in gold, making a substantial profit for the company.

Development and Shaft Sinking Proceed in Republic District

Golden Eagle Resumes — Knob Hill Mines Rich Ore—Last Chance Temporarily Shut Down

Exploration work has been resumed by the Golden Eagle Mining Co. on its property in the Republic gold district in Washington. The property has been inactive for many years. The only work on the claims consists of open cuts on the surface exposing the veins and a 500 ft. shaft in country rock from which no crosscutting was done.

The property lies on the strike of the most productive veins in the district and adjoins the Surprise and Quilp properties, the veins on which enter the Golden Eagle ground. The work started is retimbering the two-compartment 500-ft. shaft, from which exploration of the veins on the property will start.

In the same district the Surprise shaft is being sunk from the 900 level. At the 1,150 level a station will be cut and the vein picked up, but sinking will continue to the 1,400 level.

The Quilp Mining Co. is sinking from the 900 level in a winze to pick up the oreshoot on its rake to the south.

The Knob Hill Mining Co. is mining on the 800 level and taking out high-grade ore. This property was sold to the present owners as a worked-out mine two years ago, since which time it has been paid for and returned several times the sale price in dividends.

The whole district shows considerable activity; many smaller properties are embarking on exploration programs, despite the fact that only limited amounts of the low-grade ore can be marketed. The Last Chance mine has closed down temporarily.

Consolidation of New Hazelton, B. C., Properties Is Planned

The New Hazelton Gold Cobalt Mines, Ltd., the Roche du Boule and the Delta Mines, all on Roche du Boule Mountain near New Hazelton, B. C., are to be amalgamated, if plans go through, according to Nichol Thompson, of Vancouver, B. C., who is in control of the first-mentioned enterprise. Mr. Thompson says that all these properties have high-grade ore showings, carrying gold, cobalt, and arsenic, but that, owing to the general conditions, it is desirable that their efforts be co-ordinated. More economical transportation would result.

Bunker Hill Installs Heavier Electric Hoist at No. 1 Shaft

The Bunker Hill & Sullivan Mining & Concentrating Co. has just completed the installation of a new "Coeur d'Alene" heavy-duty, double-drum electric hoist for its main or No. 1 shaft, built by the Coeur d'Alene Hardware & Foundry Co., of Wallace, Idaho. Power is delivered by two 300-hp. 2,200-volt slip-ring induction motors, making a total nominal horsepower of 600, but the motors have overload capacity up to 1,000 hp.

The hoist has a rope speed of 1,000 ft. per minute and a normal rope pull of 22,500 lb. The drums are 8 ft. in diameter, with 5 ft. 6 in. face. The hoist has every modern device designed to promote safety and efficiency in operation.

The electrical equipment was furnished by the General Electric Co. The Bunker Hill & Sullivan shaft is an incline sunk from the Kellogg tunnel level. Its depth on the incline is now 2,000 ft., and the hoist is designed for an ultimate depth of 4,000 ft. The weight of the hoist, exclusive of electrical equipment, is approximately 175,000 lb. It replaces an old and much smaller electric hoist.

Utah-Apex Finds New Copper Orebody

The Utah-Apex Mining Co. at Bingham, Utah, has opened a new body of copper ore on the 2,000 level, the lowest in the mine. The mill capacity has been enlarged, and its capacity now is 375 tons daily.

Adjacent claims and properties have been acquired, minimizing, as far as possible, the repetition of litigation involving apex rights to ore which might be developed at lower levels.

The present fiscal year began Sept. 1, 1924, with cash and negotiable securities of $850,533—$70,000 of this having been received from the mine in August. Production is keeping pace with development.

Candelaria Reorganization Offers Old Stockholders Shares at 10c.

The New Candelaria Mines Co. is planning to resume work at Candelaria, Nev., in the near future, with special emphasis on development work in territory which may open new orebodies, instead of attempting to locate small bodies of ore which may have been left by early-day operators in the developed part of the mine. Changes in the mill, which should increase extraction and efficiency, are also under consideration.

The Rochester Silver Corporation has been given judgment by default for $450,000, against the Candelaria Mines Co. This amount includes foreclosure of a note, secured on the Candelaria Mines Co. property. This judgment has been assigned to the New Candelaria Mines Co., in exchange for 1,000,000 shares of its stock. Stockholders in the original Candelaria company are offered the opportunity of turning in their stock for stock in the new corporation, on payment of 10c. per share.

Porcupine Goldfields Development Finance Co. Reports

Ankerite, Young-Davidson, and Rochester Among Others—Has Option on Silver-Lead Property in British Columbia

The first annual report of the Porcupine Goldfields Development Finance Co., Ltd., for the year ended June 30, 1924, gives a comprehensive survey of the company's operations. The company has under option the Ankerite mine, in the Porcupine district; the Young-Davidson and Matachewan Canadian, in the Matachewan district; the Leker property, in eastern Quebec, and an interest in the option on a group of silver-lead properties adjoining the Sullivan mine, in British Columbia. The company also has a share holding in the Canadian Gold Mines Corporation, which has large property holdings in the Porcupine district and which is at the present time developing the Rochester claims adjoining the property of the Hollinger Consolidated Gold Mines Co. near Timmins.

At the Ankerite mine, development to date has indicated two ore zones 100 ft. apart, one of which has been opened for a length of 1,500 ft. on the 200 level and for 500 ft. on the 350 level. On the 200 level five oreshoots have been exposed having a total length of 645 ft., giving an average of $9 over a width of 6.2 ft. The company intends to continue the shaft to the 500 level and open up the veins at this depth.

Up to June 30, 11,000 ft. of diamond drilling was done on the Young-Davidson mine, in Matachewan, and underground development has now been started.

The work to date does not warrant an estimate of ore reserves, but three oreshoots are indicated by drilling, which show a possible tonnage of 100,000 tons for each 100 ft. extension in depth, with values around $8.50 a ton. On the Matachewan Canadian property, adjoining, more than 4,000 ft. of diamond drilling has been done and two oreshoots have been indicated, averaging $9.75.

The company has raised to date a total of £133,000, of which £28,500 was in the treasury on June 30, exclusive of uncalled capital amounting to £185,000.

"Long-Hole" Drilling Proves Successful in Utah Mines

"Long-hole" drilling, introduced by the Chief Consolidated Mining Co., of Eureka, Utah, and of particular value in a district where the ore deposits are irregular, is being used also by the Bingham Mines Co. at its Eureka properties. The plan is to use ordinary rock drills with jointed steel. This company has made two discoveries of importance by this system, in its Victoria and Eagle & Blue Bell properties. In the former, ore has been opened at a depth of 500 ft. below any previous find; and in the latter, ore of good grade is being produced from the 1,700 level, from a find made by long-hole drilling.

Tennis Helps in Prospecting at Beaverdell

A new lode was struck, some time ago, in grading the ground for a tennis court for the employees at the Bell mine, at Beaverdell, in the Grand Forks division in British Columbia. Already ore to the value of about $50,000 has been taken from the lode. The ore runs close to 500 oz. in silver per ton and 10 to 15 per cent of lead.

Rich Lead-Silver Ore Opened Above Animas Forks, Colo.

An important discovery by leasers on the old Mountain Queen group, situated a few miles above Animas Forks, in San Juan County, Colo., appears to be developing into one of the important strikes of the year.

The new orebody was found on the 100 level, at one side of the old workings, and has opened out into an orebody more than 4 ft. wide, samples of which run 50 per cent lead, 20 oz. silver, with small values in gold and copper.

A compressor, hoist, and tramway have been installed, and shipping facilities are being established to the Silverton Northern Ry. It is the intention to operate during the winter, stowing the ore until the opening of the road in the spring.

Lessees in Tom Reed Mine Mill 100 Tons Daily

Apparently lessees are treating almost as much ore in the Tom Reed mill at Oatman, Ariz., as when the company operated the property. About 75 tons of excellent mill rock is said to be coming daily from the Shank-Lynch lease, and other lessees are also speeding production.

It is the opinion of miners that when those controlling the Shank-Lynch lease begin operations on the 700 level, sufficient additional ore will be extracted to run the output above 100 tons daily.

The dumps of the Aztec are yielding ore that runs about $150 per ton, this ore going to the Tom Reed mill for treatment.

Every lease along the big lode in Oatman is said to be in ore, some of it of a good grade, and the possibility that future exploration in the Mother Lode will bring to light orebodies that have been overlooked by lack of crosscutting is believed to be good.

Iron Creek Mill Makes $100 Silver-Lead Concentrate

Operations have been resumed at the Iron Creek mine, near Keller, Wash. The mill is running on a two-shift basis and making a silver-lead concentrate, averaging $100 per ton in silver and lead. The tailings, which are largely oxidized, are being cyanided on the ground.

The winze, which has attained a depth of 315 ft., is being continued down with a view of blocking out more ore reserves, according to reports of J. E. Angle, manager.

Calumet & Hecla Nears Normal Following Underground Fire

Fifteen Hundred Men Idle for a Week—Bureau of Mines Canary Tested Workings on 57th Level—Damage Slight

With resumption of mining operations in the Hecla and South Hecla branches of Calumet & Hecla's conglomerate department in Michigan, only the Calumet shafts are idle as a result of the fire which broke out in the 57th level crosscut between No. 4 and Red Jacket shafts on Sept. 16. The Hecla and South Hecla shafts were closed for one week. During that time 1,500 men were idle, and the stamp mill and some of the furnaces at the smelter were shut down.

Just how much longer the Calumet shafts will remain closed is problematical, although conditions in that part of the mine are steadily improving. The blaze has been under control almost from the start, having been kept from spreading into other parts of the mine. The density of the gas at No. 4 shaft is gradually diminishing and the heat has subsided. A canary, from a Bureau of Mines rescue car, was taken underground in the Red Jacket shaft, and after a considerable time at the 57th level the bird showed no ill effects from the gas. A canary is more susceptible to carbon monoxide gas than a man. The test indicated that the shaft was safe, and soon after a crew of timbermen began the work of restoring the burned timbers at the 57th level. It was expected, however, that several days would elapse before No. 4 shaft could be entered.

There has been some caving of the ground where the timber has been burned, but the damage is not extensive. All of the burning area has been reached by water from the Red Jacket 51st level supply. Fire crews with oxygen helmets have worked in relays, day and night.

Power Bill Forces Kamloops Mines Co. Into Liquidation

The Iron Mask mine, 3½ miles from Kamloops, B. C., was sold by auction on Oct. 2. The property is equipped with mining machinery and a 300-ton straight-flotation mill, electrically driven by current from the Kamloops city plant. Last year 3,500 tons of copper concentrate was shipped to the Trail smelter. The Kamloops Mines Co., the owners of the property, was forced into liquidation to satisfy a long-overdue account for electric power furnished.

Noche Buena Mine Ships Carload of Silver Ore Weekly

The Noche Buena mine, in Sonora, owned by A. L. Gustetter and J. McCleary, of Nogales, is now said to be shipping a carload each week and production will be more than doubled upon completion of the work now under way for the installation of additional hoisting and compressor equipment. It is said that two new strikes were made at the mine recently.

When Molten Copper and Water Mix

Molten copper escaping from one of the refining furnaces in the Michigan smelter near Houghton, Mich., and coming in contact with water in the pit of the casting machine in front of the furnace caused a series of explosions early the morning of Sept. 25, that wrecked the roof directly overhead and damaged the casting machine. The night crew got safely out of the building before the stream of copper reached the water.

The copper charge in the furnace, 100 tons, was scattered about, and some of it blown outside of the plant. All of this can be recovered. The furnace itself was not damaged, the copper breaking through one of the corners at the bottom. The actual monetary loss is not large. Production will not be affected by the mishap.

Shamrock Mines Co. Contracts for 80-Ton Cyanide Plant

The Shamrock Mines Co. of Ione, Nev., has signed a contract for an 80-ton cyanide plant, which will be equipped with a Telsmith gyratory crusher and a Hardinge 6 ft. by 22-in. mill operated in closed circuit with a Vandercook classifier.

It is planned to crush to minus 60 mesh and concentrate on Wilfley tables. The concentrates will be ground in a 3 by 4-ft. pebble mill to 200 mesh. Further treatment will be in four Vandercook thickeners in which counter-current decantation will be used.

Zinc shavings will be used for precipitation. Two Vandercook mercuric generators will be used in the treatment process. Grinding will be done in the cyanide solution.

Tonopah Extension Progresses With Diesel Engine Installation

The Tonopah Extension Mining Co., the largest producer in the Tonopah district in Nevada, shipped 141,000 oz. in the first half of September, valued at approximately $120,000. This probably is the largest shipment in point of value in the history of the mine. The Extension is developing new ore in three west drifts on the 2,125 level, and these drifts are approaching the projected position of rich orebodies developed on upper levels.

Satisfactory progress is being made in sinking the Cash Boy shaft below 2,200 ft., and it is expected that the 2,250 level, where the next station is to be established, will be reached before the middle of November.

Building and foundation construction on the new Diesel engine plant is progressing as planned, and the first 2,000 hp. unit should be in operation by Nov. 1. The plant is to have an ultimate capacity of three 2,000 hp. units. The first unit has been landed in San Francisco and will be shipped to Tonopah at once. The second unit will be placed early in 1925. After these installations are complete active development can be safely carried on to the west without serious danger of flooding due to intermittency of power.

News from Washington

By PAUL WOOTON
Special Correspondent

Copper Survey by Tariff Commission To Be Thorough

Response to Demands From Michigan—Economic Questions Involved—Secondary Production Important—Changes in Foreign Production

THE SURVEY of the copper situation, ordered by the Tariff Commission, since copper is on the free list, is not made under the flexible provisions of the Tariff Act of 1922. The investigation is to be conducted under the general powers vested in the commission by the law of 1916 under which the commission is authorized to gather material for the use of Congress. This is one of the few investigations that have been undertaken under those general powers. Investigations under the flexible tariff are confined almost entirely to the compilation of comparable cost data in the United States and in competing countries. Such an investigation generally involves large expense and the employment of a considerable staff. The survey of the copper situation will be more general in character and will partake of an economic study.

The copper survey is being undertaken in response to repeated and persistent requests from producers in Michigan. The study is expected to be of unusual interest, because it is certain to produce a report which places before the Congress and the public exhaustive discussion of the respective arguments for and against a tariff on a commodity which we export in large quantities. Any argument for a tariff on copper must justify a departure from the infant-industry policy and show why it should be extended to a well-established industry which is able to compete successfully for a large proportion of the world's requirements. It is foreseen that there will be difficulties in justifying the extension of the protective tariff principle in behalf of that part of an industry which is about to exhaust its resources.

The plea of the Michigan producers for a tariff is regarded by many as an acknowledgment that they realize that their industry is on its death-bed, and hope by this method to provide the oxygen necessary to some prolongation of life.

The survey is expected to deal, among other things, with two important features of the copper industry that have been discussed but little. One will be an analysis of secondary supplies of this metal. The ratio of secondary supplies to primary production rose from 10 per cent in 1910 to 34 per cent in 1921. It declined to 30 per cent in 1922, and in 1923 was 27 per cent of the primary production.

The recovery of copper from scrap and other alloys is thought to be largely a development growing out of the war. During the war, the price of copper went to a point where it became profitable and highly necessary to salvage the metal from all secondary sources. This activity was systematized and developed to such an extent during the war that it has been profitable to continue it.

This development has not received the notice to which it is entitled, many believe. Were imports of foreign ore to increase from 10 to 30 per cent, it would come in for important attention. No such attention appears to have been given the large amount of copper coming from secondary sources. The production figures look quite different when the secondary copper is added to smelter production. Instead of 1,000,000,000 lb. in 1910, the total production becomes 1,200,000,000. In 1923, the smelter production, in round numbers, was 1,400,000,000 lb., but with the secondary production the total becomes almost 2,000,000,000 lb. It is expected that the Tariff Commission will prepare a special analysis of the secondary production.

Another phase of the situation that will receive attention is the changing character of foreign production. Australia and Japan, formerly large exporters, no longer are shipping. This has had some effect on the expansion of our over-seas markets.

The draft that Germany made on her copper resources during the war has depleted them to a point where it has an important bearing on the probable consumption of our copper in that country. The effect of low consumption in Great Britain and the complete absence from the market of Russia and Austria are other matters of moment to the industry in the United States which the commission probably will study.

Despite the demoralization in Europe, any survey of the copper situation must note the healthy condition of United States exports. In 1919 they were, in round numbers, 440,000,000 lb.; in 1920, 553,000,000 lb.; in 1921, 596,000,000 lb.; in 1922, 655,000,000 lb., and in 1923, 829,000,000 lb. For the first seven months of 1924, exports have averaged more than 90,000,000 lb. per month, which if continued during the remainder of the year will indicate exports in excess of 1,000,000,000 lb., far more than those of any year except one war year. According to the most recent figures, the contribution of the various principal American producers to world and to United States requirements are as follows:

	World, per Cent	United States, per Cent
Anaconda	27	32
Hayden-Jackling	13	22
Guggenheim	11	8
Phelps Dodge	10	8
Lewisohn	7	5
Calumet & Hecla	3	6
Paine	3	4

Oddie Wants "Strong Rooms" on Shipping Board Vessels

Would Facilitate Movement of Silver From United States to Orient, Without Transshipment at London

To remedy an important deficiency in the service performed by our merchant marine, Senator Oddie, of Nevada, in his capacity as chairman of the Senate Commission of Gold and Silver Inquiry, has urged the Emergency Fleet Corporation to equip its vessels in the Indian service with the necessary strong rooms essential to the transportation of silver bullion. In his letter to Admiral Palmer Senator Oddie says:

"I am just in receipt of the report of Consul Wilbur Keblinger, Bombay, India, of July 30, 1924, in which the following reference is made to the direct shipment of silver bullion from the United States to India, which I am sure will also be of interest to you:

"'The shipment of silver bullion from the United States direct to India on a number of occasions during the year has caused consideration of the advisability of direct dealings with New York and direct shipments from New York to Bombay instead of making purchases in London entailing transshipment at that port. The fact that Shipping Board vessels are now maintaining a monthly service between New York and Bombay will make it possible for bullion importers to rely on regular deliveries. These ships, however, are not provided with strong rooms for storing bullion.'

"In view of the above statement and the fact that silver pays a high transportation rate, it would seem that the installation of strong rooms on Shipping Board vessels routed between New York and Bombay would be a justifiable investment. The movement of silver follows very closely the movement of trade, and consequently of cargo tonnage, and it would be a decided advantage to our exporters and importers of produce to and from India if these facilities for the transportation of silver could be provided."

U. S. Mint Uses Much Silver for Foreign Coinage

The policy of the U. S. Bureau of the Mint in undertaking coinage operations for foreign countries provides a market for no small amount of American silver, it is pointed out by Robert J. Grant, the Director of the Bureau. Just at this time, for instance, the mint at Philadelphia is making 34,000,000 pieces of silver coin for Poland. To execute the order it has been necessary to purchase 7,000,000 oz. of silver. Coins are being made practically all of the time for one or another of the Latin American republics.

Mr. Grant just has returned to Washington after a visit to three mints and twelve assay offices. He says that the producers of silver are very active in their support of the legislation calling for additional purchases of silver at Pittman price to cover certain allocations of silver made for subsidiary coinage.

Manganese Associates, Twice "Relieved," Ask for More

A request for an oral hearing in the War Minerals Relief claim of the Manganese Associates, which operated in Augusta County, Va., was granted recently by the commission. The company was awarded $32,551 under the original War Minerals Relief Act. When the act was amended, liberalizing the "request and demand" clause, a motion for rehearing, claiming longer period of stimulated operation and asking revision of salvage, was filed. An award on this second claim was made in the amount of $5,347. The company recently asked for an oral hearing for the purpose of presenting additional evidence and argument with a view of establishing earlier stimulation by government officials. The commission, in granting the hearing, set the date on Nov. 14.

Phosphate Producers Apprehend Too Much Accord

The ready way in which the French and Germans bury the hatchet when an opportunity presents to make a mutually profitable commercial accord has aroused apprehension as to just how far such combines will go. The fear is expressed that this mutuality of interest is likely to extend from potash to phosphate.

The French are much interested in expanding the market for Moroccan phosphate. The facilities for making this material available at lower prices than heretofore are going ahead rapidly. Even if no actual agreement is made binding the Germans to prior use of Moroccan phosphate, the general trend toward commercial co-operation may threaten the principal foreign market of the phosphate producers of the United States.

Copper Constituent of Improved Asphalt Pavement, Is Claim

Articles of incorporation for the Willite Company of Arizona have been filed with the State Corporation Commission. Officers of the company, elected at a recent meeting of the incorporators, are H. G. Feraud, president; Joe V. Prochaska, vice-president; George H. Clark, secretary; and James B. Girand and C. C. Cottrell, directors. "Willite" is the trade name for a particular type of asphaltic pavement; in fact, it is, according to Mr. Cottrell, any standard asphaltic pavement which has been treated by the Willite process. This process consists of the addition of a small quantity of copper sulphate to the asphaltic cement. This addition has been found to change its composition materially, making it tougher and more resistant to the hammering of traffic. The practical result of this is to insure a smooth, easy riding, and permanent surface.

Mr. Cottrell says that since Willite has been put on the market nearly 1,500,000 lb. of copper has been used in such a way that it is unrecoverable. Many miles of such pavement have been laid in the last five years.

Johannesburg Letter

By John Watson
Special Correspondent

Engineers Visit West Springs' New Cyanide Plant

Tube Mills, Pachuca Agitators, Butters Filter, Merrill Precipitation Included in Process

Johannesburg, Aug. 25.—A party of about 180 members, representing the Chemical, Metallurgical and Mining Society and the South African Institution of Engineers, visited by invitation, on Aug. 14, the West Springs mine, where the new all-sliming process was seen at work. An ore bin of 2,000 tons' capacity, with a bottom of the saw-tooth type, delivers alternately to four tube mills on each side, staggered in relation to each other. This arrangement allows the tubes to be set at 30-ft. centers and still secures a self-emptying bin. The effluent from the tube mills is divided by a ½ in. mesh trommel into reject pebbles, which are transferred by belt conveyor to the reject pebble plant, and pulp, which is elevated by means of cyanide solution (supplied under pressure) to the rake classifier.

From this classifier, the over-sized part is returned by gravity to the tube-mill feed hopper and the finished product overflows to the main slime launder leading to the elevator pumps which deliver to six conical-bottom slime collecting tanks. After agitation and treatment in seven Pachuca tanks, the slime is pumped to the Butters filter plant, which is of the all-gravity type. Precipitation of the gold from solution is carried out by the Crowe-Merrill process. After inspecting the plant, the party were entertained to lunch in the Springs Recreation Hall by officials of the Anglo-American Corporation.

The probable life of the Rand as a gold producer is often discussed. The Government Mining Engineer, in his last annual report, estimates that at the end of 1927 there will be twenty-four gold mines on the Rand (exclusive of small mines crushing less than 20,000 tons per annum). These twenty-four mines will mill 20,000,000 tons per annum and yield gold valued at £31,000,000. Five years later, at the end of 1932, he estimates the number of big producers at twenty-one, crushing 19,000,000 tons per annum and yielding gold to the value of £29,000,000. Sir Roberts' forecast takes no account of new producers other than New State Areas and West Springs.

The Umtali District Publicity Association has recently issued an attractive brochure of "The Eastern Gateway of Rhodesia." Up to October, 1923, the Umtali district had produced the following values of minerals: gold, £3,816,222; silver, £185,649; lead, £94,789; copper, £11,369; arsenic, £51,185; scheelite, £3,362. The production of copper started only in 1917 and that of arsenic and scheelite in 1918. Some prospecting is being done in the district.

Australian Letter

By Our Special Correspondent for Queensland

Mount Morgan Improves Recovery in Concentrating Department

Thereby Reduces Operating Loss — Saint-Smith Declares Mount Isa Has Blocked Good Tonnage

Brisbane, Aug. 31—In the endeavor to economize in the cost of working, so as to reduce the loss of the last three years, the Mount Morgan Co. has, in the last twelve months, made several changes in ore treatment that have resulted in better recoveries. Among other improvements, alterations have been made in the concentrating mill which gave more efficient work in both copper and gold. For the last half of the later period the figures were over 96 per cent of copper and more than 83 per cent of gold.

Efforts in the direction of improving the milling practice, also, are being actively pursued, with the primary object of still further decreasing the silica content of concentrates and so reducing the fluxing charge on subsequent smelting operations. By increasing the output of the company's own colliery at Baralaba, the coal from which is of an anthracitic nature, the coke bill at the works, too, has been reduced.

E. C. Saint-Smith, before relinquishing his position as mine superintendent of the Mount Isa company to resume his post on the Queensland Government Geological Survey, has made a comprehensive report on the various leases of the company. In his concluding remarks, he says that, as the geological conditions of this new field are different from those of any other silver-lead field in the world, it is premature for anyone to dogmatize on what will eventually happen to the various orebodies of Mount Isa below the admittedly present shallow workings. Nothing, he says, short of actual demonstration by deep sinking and driving, with preferably testing at still greater depths with diamond drills, will be of any real service. Of the known orebodies being investigated on the company's property, in his opinion the Black Star, Black Rock, Rio Grande, Isa, Myra, and Racecourse lines of lode, will, in the order given, furnish the bulk of the payable ore won in the future. The first-named constitutes by far the most important deposit yet located on the field. Fortunately, Mr. Saint-Smith adds, the data already obtained assure the extent, at the main outcrop, of a good tonnage of payable material that can be economically mined.

News has been received at Cairns, North Queensland, of what appears to be an important gold find in the Northern Territory of Australia. The discovery embraces an extensive belt of gold-bearing country at a place called Mundogie Hill, about 20 miles from navigable water. In addition to placer gold, ironstone found at the hill assays from 2 to 4 oz. to the ton, while other assays of bulk samples go 7 and 10 oz. The find is about 70 miles from the Pine Creek station, on the main transcontinental telegraph line.

Briseis Tin Mine, Tasmania, Has 7,000,000 Yd. of Gravel

The Briseis mine at Derby, in Tasmania, is one of the most profitable tin properties in Australia.

In the large-scale operations carried on by the mine company, the course of the Ringarooma River has been turned behind the mine, so that the deep lead may be followed across the original bed of that stream.

The gutter at the mine containing the tin has been tested ahead, and it is estimated that about 7,000,000 cu.yd. of drift is available, which it is calculated should yield approximately 5,000 tons of tin oxide. Ever since the mine has been under the control of the present general manager, Lindesay Clark, operations have been successful.

London Letter

By W. A. Doman

Special Correspondent

Rhodesian Congo Border Concessions Has Encouraging Outlook

Copper Deposits Seem To Be Large—Active Development Under Way —Portuguese Tin Company

London, Sept. 16—A short time ago I referred to the progress made by the Rhodesian Congo Border Concessions, of which A. Chester Beatty is a director. Hitherto the public has not been invited to share in this undertaking, the directors presumably preferring to test the property thoroughly before inviting outside capital. For a very considerable time they have known of several deposits; in fact, the deposits may lie in a belt. Further work has been done, and a circular has just been issued containing an important statement. The company has forty-two discoveries to date, made both by borehole and surface work. The directors state that the information now received indicates that at N'Changa there is a copper mine of great potential value, with a large tonnage of relatively high-grade ore. Sulphides have been discovered showing an average grade of between 4.5 and 5.5 per cent copper; other large deposits of lower-grade are also being tested, and ten prospecting parties are now in the field.

A new discovery is that at Dambo, the copper-bearing formation being approximately 1,100 yd. south of the main N'Changa lode, and the two orebodies converge toward the west. Shaft sinking and further diamond drilling are to be undertaken.

The sources of the world's tin supplies are fairly well known, and though Portugal is not a great producer there is a Portuguese Tin Trust. As usual, a certain amount of British capital is employed, mainly in dredging. A new company — the Castelo Branco Tin

Briseis Tin Mine in Derby, Tasmania

The Ringarooma River has been diverted to permit mining operations.

(Portugal)—has been formed to take over certain tin-bearing properties and to acquire any tin-dredging areas that may be available. The nominal capital is only £20,000 in 2s. shares, which suggests that either this is the initial capital or that the properties are small.

It is said that representatives of the Northern Exploration Co. have discovered extensive deposits of zinc ore in Spitzbergen, and that samples have been taken to Christiania for analysis. According to a message from Christiania, if the new mines fulfill expectations, an important zinc industry will be in operation next year. At the time of writing, the directors of the Northern Exploration Co. have not received any information of commercial quantities being discovered on the mainland upon their property.

It had been hoped that the Minerals Separation had found a process that would treat the ore at the Pilbarra Copper Fields, and this seems to have been the fact, but the cost of installing the plant is heavy and the scheme has been abandoned. Minerals Separation gave the opinion of their representatives that the treatment of 4 to 5 per cent copper ore would give an extraction of about 90 per cent copper after 15 per cent of the finest material had been removed for future treatment. Costs were stated thus: Plant, £56,000, with a contingency allowance of £8,000. Ammonia, £13,500, of which £2,500 is required for the first three months' consumption, £11,000 remaining locked up in the plant and to be eventually recovered; £6,000 for coal or oil stock and £13,500 for water supply. The total estimate was subsequently increased to £114,000, and was so much in excess of the estimate made before the visit to Australia that the directors could not entertain it. One great drawback is the cost of ammonia.

It is said that the problem at Bwana M'Kubwa (Rhodesia) is somewhat similar, and that the outlay on ammonia is high.

Toronto Letter

By Our Special Correspondent for Northern Ontario

Ontario Gold Output Increased 36 Per Cent for Half Year

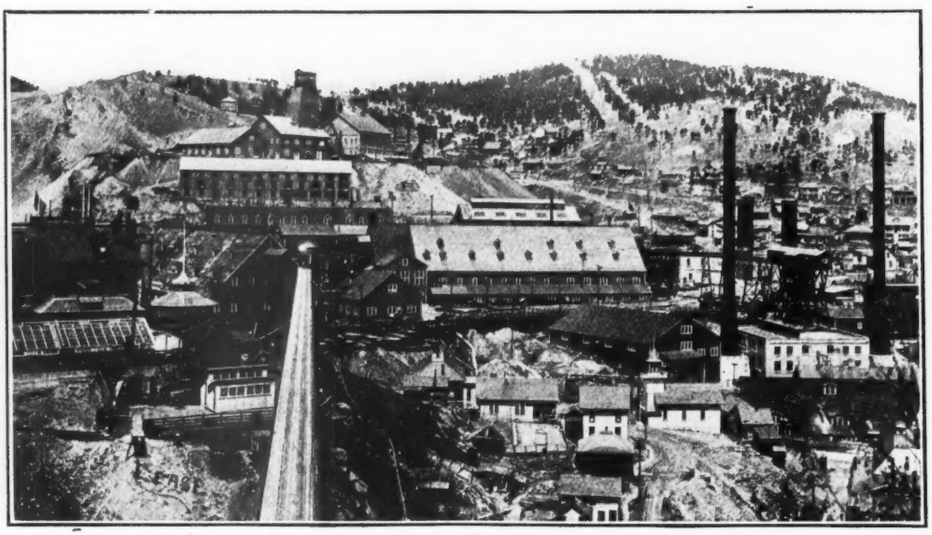
Adequate Power Helped — Hollinger Largest Contributor—Teck-Hughes Heads List at $25.22

Toronto, Sept. 27—Gold production in Ontario of $11,810,060 showed an increase of $3,160,000, or 36 per cent, during the first half of 1924 over the last corresponding period. This was due to a considerable extent to the ample supply of hydro-electric power throughout the year. The average recovery per ton from all Ontario mines was $8.59, compared with $8.82 in 1923, but the decline in costs was more than sufficient to offset this somewhat smaller average recovery. The average recovery in the Kirkland district was $16.11 and in Porcupine $8.14 a ton. In the Porcupine district a total of 1,260,000 tons, was treated, an increase of 380,000 tons. The highest grade mined in the camp was at Vipond, with an average of $13.74; the Dome was $8.94; McIntyre $8.82, and Hollinger $7.60 a ton. The total recovery in the Porcupine district was $10,260,000, of which the Hollinger contributed $6,172,000; Dome $2,115,000; McIntyre $1,667,000, and Vipond $304,500.

In the Kirkland district the highest grade produced was the Teck-Hughes, with an average of $25.22 a ton; the Lake Shore average was $23.86, and the Wright-Hargreaves $10.81. The total tonnage treated in the Kirkland district was 116,184 tons, which produced $1,359,000, of which the Teck-Hughes contributed $550,000, the Lake Shore $319,000, and Wright-Hargreaves $444,000. The output of silver totaled 5,008,256 oz.

The annual report of the Vipond mine, of the Porcupine district, for the period ended July 31 last shows that for the eight months during which the mill was in operation 29,783 tons of ore was milled, of an average value of $13.53, from which bullion to the value of $379,075 was recovered. During this period the operating profit was $100,500, and after deductions for depreciation, development, redemption, and taxation, the net profit was $51,500. Ore reserves as of July 31 were estimated to be 315,423 tons, averaging $9.60 per ton, or a total of $3,010,347. The balance sheet shows cash assets of $180,400 and current liabilities of $21,600.

The assets of the new Rhodesian Mines & Investment Co., Ltd., are being taken over by the Anglo-Ontario Mines, Ltd., which is a Canadian exploration company financed by John Taylor & Sons, of London, and associates. Shareholders of the Rhodesian Co. are being circularized to the effect that the Anglo-Ontario is now being financed privately and that the directors intend to assist by subscribing to its working capital. For that purpose arrangements have been made with the Rand Minerals Exploring Co., Ltd., to place at the disposal of the shareholders 100,000 shares of 2s. 6d. each into new Rhodesian Mines & Investment Co. at the price of 2s. each. The Anglo-Ontario will take over an interest in three claims adjoining the Keeley mine, as well as the Porcupine Crown and Thompson Krist properties in Porcupine. Shareholders in the Rhodesian Co. can take up two new shares for each five shares now held and will have the right for twelve months of converting their Rhodesian into Anglo-Ontario shares on the basis of one share of Anglo-Ontario for each two Rhodesian shares and applying for a $1 share in the Anglo-Ontario at the price of 4s. The Anglo-Ontario has a number of properties under option in Ontario, Quebec, and Manitoba and has one property of particular interest lying to the east of Lake Winnipeg in the Bulldog Lake Section, where very favorable results are being obtained.



The Homestake, famous old gold mine of the Black Hills, in South Dakota

Men You Should Know About

Charles H. Gould, director of the Oklahoma Geological Survey, has in preparation several manuscripts and bulletins on Oklahoma's mineral resources, which will be published as appropriations become available. He is planning a vigorous campaign to give publicity to Oklahoma's vast mineral wealth. In 1922 the state ranked second in the value of its mineral resources, being exceeded only by Pennsylvania. Mr. Gould has estimated that the average value of Oklahoma's mineral production for the last six years has been $354,000,000, of which petroleum supplied 87 per cent.

Charles H. Gould

J. A. Burgess has returned to San Francisco from Park City, Utah.

F. B. Weeks is at Daggett, Calif., studying the old Calico district.

A. H. Brooks, R. H. Sargent, and **J. S. Brown** arrived in Seattle from Alaska on Sept. 28.

Hugh Park, general manager of the Nipissing Mining Co., of Cobalt, Ontario, Canada, is in New York.

R. S. Dening has been appointed Secretary of the Keeley, Vipond, and Canadian Lorrain mining companies.

A. M. McQueen, vice-president of the Imperial Oil Co., is visiting the properties of the company in western Canada.

M. F. Coolbaugh and **J. B. Read** were recently in San Francisco. Both are co-workers in developing the Coolbaugh process.

H. W. Hardinge has returned from Europe, where he has been for the past four months on foreign business for the Hardinge Company.

H. McLean, who has been representing English interests in negotiations for the purchase of the Goldacre property, in the Porcupine field, has sailed for England.

George E. Farish sailed recently for Naples, Italy. He will be in that country for several months on business, visiting the mines of Transylvania before returning to the United States.

Brigadier General J. C. Greenway and **Senator W. A. Clark** have just returned from inspecting the Girand dam site at Diamond Creek, Arizona. General Greenway and his associates express hope that the Federal Power Commission will permit construction on the Diamond Creek project to begin soon. The granting of a permit has been held up by the refusal of the Arizona Legislature to ratify the Colorado River Compact, which allocates waters of the Colorado River among those states through which its waters flow.

C. Lorimer Colburn, mining engineer, has resigned from the staff of the U. S. Bureau of Mines to again engage in private practice as a consulting mining engineer, with headquarters at Denver, Colo. Before the entrance of this nation into the World's War, Mr. Colburn conducted an engineering office at Denver in partnership with the late Carl A. Allen, who later became chief mine inspector of the State of Utah. Mr. Colburn served as a captain of engineers in the World War and immediately after the armistice entered the staff of the U. S. Bureau of Mines as a metal-mining engineer. He later became assistant chief mining engineer, and in 1921 was assigned to a cooperation between the Bureau of Mines and the National Safety Council. While in this position he arranged safety conferences at Duluth, Minn., for the iron and copper mines of the Lake Superior district; at Butte, Mont., for the metal mines for the northwest; and at Globe, Ariz., for the metal mines of the southwest. During the last year, Mr. Colburn has been serving as director of the Joseph A. Holmes Safety Chapters. In returning to Denver, Mr. Colburn is taking up again the engineering practice that was interrupted by the war.

C. Lorimer Colburn

Colonel W. B. Thompson, of New York, who, as recorded in our editorial and news pages this week, has recently endowed an institute for plant research, has also established an arboretum on his estate about three miles west of the Magma mine, at Superior, Ariz., for research work in connection with plants adapted to the arid Southwest. Two homes are in course of construction on the property, in the vicinity of Mr. Thompson's own residence, and when completed these will be occupied by **Professor Crider,** formerly of the State University, and **Mr. Gibson,** who will move in at once and devote their entire time to the work.

Obituary

Thomas G. Brady, one of the pioneers in the development of the iron ore and copper resources of Cuba, died in Washington on Sept. 22. In his experience as mining engineer he did important work, in a consulting capacity for the Krupp interests and for the Bethlehem Steel Co. He also participated in the development of a group of Mexican properties owned by Scotch interests. For a number of years Mr. Brady was associated in engineering work with the late Robert M. Stanton, of New York.

Paine Studio, Washington, D. C.

Thomas G. Brady

D. B. Donovan, assistant inspector of mines for the Krugersdorp district of South Africa, died of heart failure on Aug. 23. Mr. Donovan was only thirty-nine years old, but in addition to his Rand experience, had spent seven years on the Gold Coast as a consulting engineer. Mr. Donovan's death occurred just as the members of the new session of the Chemical and Metallurgical Society were assembling at the Scientific and Technical Club, in Johannesburg, and the meeting adjourned one week as a tribute of respect.

Dr. Edmund Otis Hovey, curator of geology at the American Museum of Natural History and leader of the MacMillan Crocker Land relief expedition in the North, died in Yonkers, N. Y., on Sept. 27. Dr. Hovey was born at New Haven, Conn., in 1862. He was long associated with Yale University. In 1884 he received his Bachelor's degree at Yale and later his Ph.D. He made his first geological exploration in 1890 as a member of the U. S. Geological Survey, and while with the Museum he made two other trips with government parties to the tropics and the Far North. He lead the 1915 expedition of the American Museum to the West Indies, and on his return was sent to rescue MacMillan and his party, stranded near Etah, Greenland. Burial was at New Haven, Conn.

Societies, Addresses, and Reports

William Boyce Thompson Founds Institute for Plant Research

Official Opening at Yonkers—Benefaction to Humanity—Emphasizes Need for Research in Pure Science

FOR several reasons the official opening of the Boyce Thompson Institute for Plant Research at Yonkers, New York, on Sept. 24, is of unusual interest to the mining fraternity. First, because of the man who founded and endowed it; second, because of the immense practical value to humanity—a value not generally realized by those not familiar with plant science—of the work to be done; and, third, because of the thesis regarding the need for research in pure science, before applied science can make headway, that was propounded by the eminent gentlemen who participated in the program at the opening.

© *Harris & Ewing*

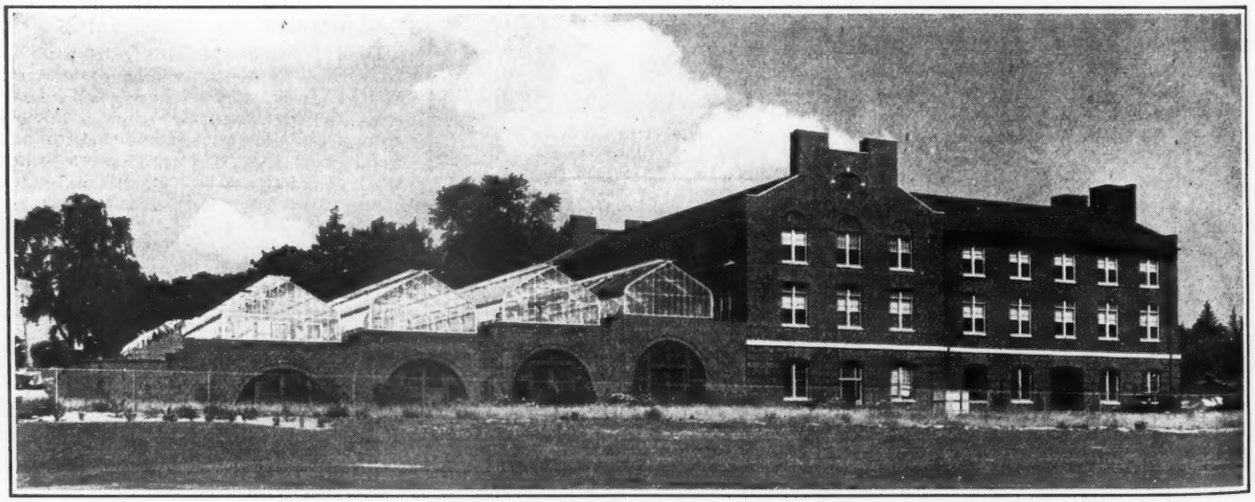
Colonel William Boyce Thompson

Colonel William Boyce Thompson was born at Virginia City, Mont., in 1869, when that old camp gloried in its gold and its vigilantes. Ten years later, when the digging in Alder Gulch became lean, the Thompson family moved to Butte. It is suggested that the tribulation of the boy in his efforts to raise vegetables for his mother's kitchen in the sulphurous environment of Butte's copper smelters planted the seed that has now flowered in this new enterprise. At any rate, Colonel Thompson's material success and his acquisition of wealth have been the result largely of his genius in organizing and directing big mining enterprises. He studied mining engineering at Columbia, and the mining industry rightfully takes pride in the splendid work that he has just set in motion.

Few realize that with the normal growth of population this country in another century will have 300,000,000 people. Nor do they know that the rate of domestic production of food and clothes is rapidly falling behind the increase in population, and plant life is the foundation of every growing thing on which mankind depends. This discrepancy is aggravated by the fact that plant pathology is increasing. The problems of the plant scientist are not only to solve the problem of isolating and killing disease, but of increasing the yield of healthy plants.

It is true that various federal and state bureaus and some university departments are engaged in research, with the object of helping the farmer. But they are handicapped in many ways. No institution seems adequately financed and equipped to conduct fundamental research, to explore the realms of the unknown—to solve, in a measure, the mystery of the phenomena of plant life of which Nature seems so jealous. The present institutions are nearly at the end of their resources, say the officials. They must have answers to questions regarding basic facts if they are to proceed, and it is this that the Boyce Thompson Institute sees as its all important function.

A magnificently equipped building with extensive laboratories and modern greenhouses has been built. The visitor is surprised at the equipment that is needed. Ventilating systems, refrigerating plants, vacuum machinery, air compressors, a carbon-dioxide plant, electrical installations, light filters, artificial-daylight rooms, are a few of the facilities that are provided to carry on the work of research. But the best equipment will not avail unless the staff of men and women engaged is thoroughly competent. In the end the results will depend most on the caliber of the scientists who are chosen to do the work. The selection of the personnel indicates that no one is better aware of this than Mr. Thompson.



The Boyce Thompson Institute for Plant Research at Yonkers, New York

Developments in Non-ferrous Metallurgy Discussed

Topic of W. M. Corse, Who Delivers Annual Autumn Lecture Before Institute of Metals, in London

Recent developments in non-ferrous metallurgy in the United States were discussed, with special reference to nickel and aluminum-bronze, by W. M. Corse, of the National Research Council, Washington, D. C., at the meeting of the Institute of Metals held in London recently. This was the subject selected for the third annual autumn lecture, which was delivered by Mr. Corse.

The purpose of the speaker was to describe recent non-ferrous metallurgical developments in the United States, with special reference to those that are new or those about which published information has been difficult to obtain.

Nickel was described from the historical standpoint, and the various outstanding data in its development were given. Its occurrence was discussed and the smelting of the ore into so-called Bessemer matte was described.

The refining methods differ with each of the three principal companies, although the smelting methods are practically the same. Each method of refining was outlined. These are the Orford, Mond, and Hybinette processes. The properties of nickel were given and its commercial uses mentioned in detail. Monel metal was described and the topic concluded by paragraphs on the alloying properties of nickel and its nonmetallic forms.

The copper-aluminum alloy known as aluminum bronze was next described with special reference to its commercial rather than its scientific development. The addition of lead to the standard aluminum bronze has given a new alloy of splendid wear-resisting properties. The result of a special test of such an alloy shows excellent results.

Economic and Industrial Mobilization

Mobilization of materials and munitions rather than of soldiers is the primary problem of a nation entering war. Six months after the United States entered the World War, trained men were available, but more than eighteen months elapsed before they were adequately equipped with American-made munitions. An explanation of the plan whereby the preliminary work for mobilizing industry for war will be done before the declaration of a possible war, was the purpose of a meeting held at the Engineering Societies Building on Defense Day, Sept. 12. Judge E. H. Gary, chairman of the Advisory Committee that is co-operating with the Army officials, presided at the meeting, which was attended principally by engineers and officers of the Reserve Corps.

Mr. Gary, after assuring his hearers that adequate preparation was the best measure, first, to prevent war, and then to assure speedy and successful waging of war in the event of its coming, introduced Colonel J. L. Walsh, of the regular Army, who is in charge of the New York ordnance district. He said that the last war cost us $2,000,000 an hour, or $25,000,000 a day. If by being prepared we could save three months of war, the country would net about 2½ billion dollars. This he thought justfied the mobilization of material and munitions sufficient to bridge the gap between the declaration of war and the organizing of a manufacturing program adequate to keep up the supply.

General Robert L. Bullard illustrated the situation in which our first fighting units in France found themselves by saying that they first borrowed guns from the French, then bayonets, then gunny sacks to make dummies to practice fighting on, and finally an officer had to spend two days in Paris negotiating for some twine with which to hang the dummies in a "fighting" posture!

Guy E. Tripp, chairman of the board of Westinghouse Electric and Manufacturing Co., pledged the active support of the industrialists to the program of the War Department. He told how $12,000,000,000 worth of war contracts were negotiated under President Wilson without a suspicion of fraud. "Not a war activity, but the best assurance of peace," is the way the preparedness program was described in his closing remarks.

Prospectus Should Include Report of Engineer of Standing, Says Resolution

Person Making Examination Should Be Independent

At the meeting of the New York section of the Mining and Metallurgical Society of America at the Harvard Club, New York, on Sept. 24, a resolution submitted by Allen H. Rogers was adopted. The text of this resolution follows:

"Whereas, it is common practice amongst bankers in underwriting or in selling the securities of mining or metallurgical companies to accept, and publish, in support of the value of such securities, the statements of owners, officers, or employees of such companies; and

"Whereas, the public, on being invited to subscribe to an issue of securities, is entitled to a full and unbiased independent opinion of the value of the property represented by such issue; now, therefore, be it

"Resolved, that the Mining and Metallurgical Society of America urges upon bankers and other houses of issue the incorporation in any prospectus published by them of a report or opinion of an independent mining or metallurgical engineer or geologist of standing on the value of the property represented by the securities described, in the same way that the legal phases of the transaction are vouched for by lawyers; and be it further

"Resolved, that the attention of the public be directed to the desirability of demanding such a report before investing; likewise, of Stock Exchange authorities to the desirability that the engineering report which is required for listing be made by an independent engineer."

Lake Superior Section A.I.M.E. Honors William Kelly

A luncheon in honor of William Kelly was held at the Wawonowin Golf Club, at Ishpeming, Mich., recently, at which the members of the other local sections of the Lake Superior Section of the American Institute of Mining and Metallurgical Engineers were the guests of the local members. M. M. Duncan presided, and addresses were made by Mr. Kelly, president of the Institute; J. E. Jopling, president of the Lake Superior Mining Institute; O. C. Davidson, E. W. Hopkins, and others. Following the luncheon the members played golf. Forty-two members were present.

Iron and Steel Institute Will Meet Oct. 24

The twenty-sixth general meeting of the American Iron and Steel Institute will be held at the Hotel Commodore, New York City, on Oct. 24 next. There will be the usual sessions, morning and afternoon, at which Judge Elbert H. Gary will give his address and technical papers will be read. This will be followed by a banquet in the evening.

Recent Technical Publications

Taschenbuch für Berg & Hüttenleute. Edited by Dr. F. Kögler. Published by Wilhelm Ernest & Sohn, Berlin. Price 29.4 Swiss francs or their equivalent.

Like a good many engineers' handbooks, this volume is far too bulky for the average pocket, but this is not strange when one considers that compressed between its covers, in 1,477 pages, is an attempt to treat the whole field of mining and metallurgy. The reader examining this work will naturally make a comparison with those handbooks in the English language that deal with identical topics and with which he is familiar. He will find many points of similarity and many of contrast.

In the first place, Dr. Kögler's book is comprised of a group of chapters each written by a specialist in some branch of mining or metallurgy. In that respect it resembles many of the handbooks published in this country. But in the context of the volume many dissimilarities will be noted. Local practice is mentioned almost exclusively. Citations of North and South American, African, or Australian methods are given infrequently. On the other hand, such subjects as the construction of elaborate steel and concrete shafts, the congelation process of sinking shafts, briquetting, and the mining of potash, receive extended treatment, although only of moderate interest to mining engineers here. This editorial treatment is readily understandable, however, as it reflects the viewpoint of the Continental engineer who has to meet the problems discussed in these chapters and for whom the work is primarily intended. But it does seem as if the book could have been a little better balanced. For example, flotation is dismissed with six pages; briquetting receives 56. Perhaps the European mining engineer is not interested in flotation so much as his North American colleague.

What the book briefly treats in some sections it more than makes up in others. Thus, the section on Diesel engines, as might be expected, is splendid. So is that on general mechanical equipment for mines and mills, although only European machinery is used for illustrations. The absence of any description of modern American types of ball-milling machinery is noticeable. Electromagnetic separation of the minerals receives adequate and comprehensive treatment.

The main strength of the work lies in its handling of subjects which are of especial technical concern to engineers abroad. And herein will also lie its appeal to American readers, for those of them desirous of learning how other countries tackle their problems can find much of interest and value to them in this book.

The size of type that has been used is a little larger than that ordinarily found in most American handbooks, making the pages easier to be read. The line drawings with which the volume is profusely illustrated are uniformly excellent and well executed.

F. E. Wormser.

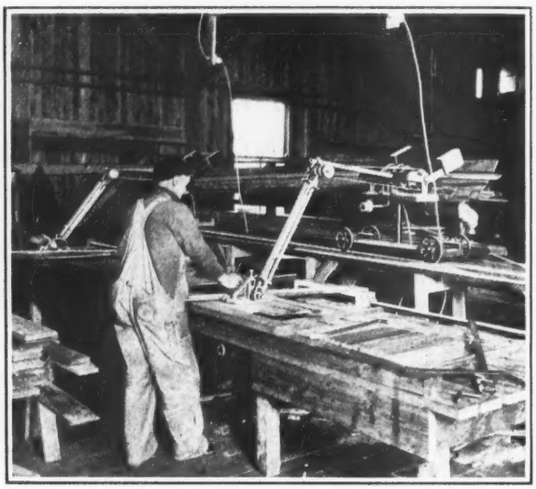
New Machinery and Inventions

A Time-Saving Wood-working Machine

By using the wood-working machine shown in the accompanying photograph a saving in time and labor costs may be made by mines having much timber construction or concrete work to do. As it cuts, measures and squares the ends of forms, and is so flexible that only one motion of the arm is necessary to get either square or beveled ends, it is found particularly useful in the rapid construction of all types of work, the makers assert.

The machine is mounted on a four-wheel carriage with roller bearings, and the swivel post is carried on ball bearings. The sawing head may be adjusted so as to cut any angle up to 55 deg. and this feature adapts the machine to cutting timbers for all sorts of construction work. In cutting circular holes for column head forms, a radius rod, adjustable for various sized circles, guides the tool around a perfect circumference.

Being portable, the machine may be taken to any job or any part of a job where electric current is available. The manufacturer is the P. L. Billingsley Co., 425 Elm St., Cincinnati, Ohio.



Measuring is automatically done by this wood-working machine when the squares of the machine are pulled down, and the saw starts to work immediately. Much time in making forms is thus saved.

A New Instrument for Measuring Differences in Elevation

A new instrument for the instantaneous measurement of differences in elevation, called the Navigator, uses the Paulin system to obtain accurate results. The zero-gaging method is employed in weighing a column of air by means of the tension in a spring. The results are transferred to the dial of the instrument by a new and novel method that obviates lag from friction and inertia. The diaphragm capsules within the instrument, at low vacuum, are always in their normal position, never deformed. The external pressure on them is transmitted to the indicator on the dial without the aid of gears, levers, or chains. The Navigator is light in weight, and the results are readable without removal of the instrument from its case. Three types are available:

Type H-1 a. Equipped with altitude and barometer scales. Range from 1,000 ft. below to 4,000 ft. above sea level. It can be used to indicate 1 ft. difference in altitude.

Type H-1 b. Of the same size and weight as the former, but with a range from 1,000 ft. below and 10,000 ft. above sea level. Instruments of other range can be furnished upon request.

The above-mentioned types, it is claimed, are well suited for the mining engineer, for use under and above ground.

Type H-2. This is known as the leveling instrument, available for the measurement of small differences in elevation, such as 6 in. The standard range of this instrument is from 500 ft. below to 3,000 ft. above sea level. It is adapted for use in connection with mapping, tunnel levels, and ditch and pipe-line construction.

Airplane altimeter. This is another instrument for use in aerial work—for mapping, photography, night flying, or in fog. It gives the exact elevation when being read, regardless of the speed of ascent or descent.

All instruments are compensated for temperature changes. Their distribution is in the hands of Navigator Instruments, Inc., 383 Mills Building, San Francisco, and Paulin System Instruments, Inc., 331 Madison Ave., New York City, where demonstration will be made to anyone interested.

American Machinery To Be Shown in London

There will be an American section at the 1925 Shipping, Engineering and Machinery Exhibition in London. Sir Charles Parsons is the president of the organization, which conducts such an exhibition each two years. F. W. Bridges, the general manager of the show, will visit the United States in October to confer with the American manufacturers who may be interested in participating in next year's exhibition.

Trade Catalogs

Electrical Equipment—A 27-page bulletin on automatic station control equipment has recently been issued by the General Electric Co. and is designated as No. 47,731. It describes briefly the uses and advantages of this type of equipment, and is well illustrated. The greater part of the bulletin is given over to a list of installations up to Jan. 1, 1924, giving the name of the company, station, type of apparatus, kilowatt capacity, and incoming and outgoing voltage.

Pumps—Twenty-two pages of pump data punched for binding in a catalog have been received from the Aldrich Pump Co., of Allentown, Pa. These are entitled "Engineering Tables, Pump Data 50," and are intended to supersede previous issues of No. 50.

Mine Lamps—The Dewar Manufacturing Co., 28-30 Thirty-fifth St., Brooklyn, N. Y., has issued a leaflet announcing its line of mine car trip and signal lamps, as well as cap and hand lamps and those of miscellaneous types.

Portable Air Power—The Ingersoll Rand Co., 11 Broadway, New York, has issued a 72-page book entitled "100 and 1 Ways to Save Money With Portable Air Power." It contains an up-to-date and complete description of portable air compressors, the company claiming that some of the applications have never been described before. Cost data comparing methods versus machine methods are given. The book describes the use of such tools as the paving breaker, "Jackhammer," rock drill, trench and clay digger, backfill tamper, "Little Tugger" hoist, tie tamper, pneumatic drill, riveter, calking hammer, drill steel sharpener, sand blast, paint spray, cement gun, and others. Copies may be had by applying to the head office at 11 Broadway.

Electric Furnaces—The Detroit Electric Furnace Co. has just issued a catalog describing in detail the advantages, performances, and results obtained with the company's electric brass furnaces in the brass-melting field. This booklet is known as the "Speedier Production-Better Brass" catalog, and contains specific information with illustrations. Copies may be had from the company, 2,331 First National Bank Building, Detroit, Mich.

Trolley Tap—A folder of the Ohio Brass Co., Mansfield, Ohio, describes a new trolley tap—a fused device for connecting trolley line and trailing cable of loading machines, reel locomotives, portable pumps, portable conveyors, welding machines, and room hoists.

Engineering Instruments—A leaflet issued by Navigator Instruments, Inc., 383 Mills Building, San Francisco, Calif., announces a line of precision aneroids under the name "Navigator Instruments," which embody the recently patented Paulin system.

Pumps—Dorrco diaphragm pumps, suction and pressure, are covered in Bulletin 13 of The Dorr Company, 247 Park Ave., New York, which has just been issued. The catalog contains twenty pages illustrated.

The Market Report

Daily Prices of Metals

Sept.	Copper, N. Y. net refinery	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
25	12.625@12.75	46.625	47.125	8.00	7.80@7.85	6.10@6.15
26	12.625@12.75	46.625	47.125	8.00	7.80	6.15
27	12.625@12 75	46.625	47.125	8.00	7.80	6.15
29	12.625@12.75	47.375	47.875	8.00	7.80	6.15
30	12.625	47.50	48.00	8.00	7.80	6.15
Oct.1	12.625	48.00	48.50	8.00	7.80	6.15
Av.	12.667	47.125	47.625	8.00	7 804	6.146

*These prices correspond to the following quotations for copper delivered: Sept. 25, 26, 27 and 29, 12.875@13c.; Sept. 30 and Oct. 1, 12.875c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

The quotations are arrived at by a committee consisting of the market editors of *Engineering and Mining Journal-Press* and a special representative of the Bureau of Mines and the Bureau of Foreign and Domestic Commerce.

London

Sept.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
25	62¼	63¼	66½	234¼	236¾	32⅝	32⅜	32⅝	32⅝
26	62¼	63¼	66½	233½	235¾	32⅜	32½	32⅜	32⅝
29	62¼	63¼	66½	236¾	239¼	33	32¾	32⅝	32⅝
30	62¼	63¼	66⅝	239¼	241¼	33⅛	32¾	32⅝	32⅝
Oct. 1	62	62⅞	65¾	238¾	241	33⅛	32⅝	32¾	32¾

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Sept.	Sterling Exchange "Checks"	Silver		Gold London	Sept.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
25	4.47	69¾	35	92s 05d	29	4.45½	70	35⅛	92s08d
26	4.46⅝	69⅞	35 1/16	92s 06d	30	4.45¼	70⅛	35 3/16	92s10d
27	4.46⅛	69¾	35	... ...	Oct. 1	4.46	70⅛	35⅛	92s08d

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-quarter of a cent premium.

Metal Markets Continue Quiet

New York, Oct. 1, 1924—The week past has been one of the dullest on record in the non-ferrous metal markets. In copper especially the absence of substantial buying was noticeable. The bright spots have been the continued strength of lead and the further advance in the price of silver, which established a new high mark again.

Copper Market Very Inactive

Although last week was a slow one in the aggregate tonnage of copper sold, this week has been even worse in that respect. Consumers have been interested enough to inquire about the market, but have not placed much business. Thirteen cents was a top price for the sales made, but shading of this level down to 12¾c. delivered was common. Today the metal can be readily procured for 12¾c. The colorless appearance of the market is due to the fact that while producers have not pressed any metal for purchase, consumers have not been anxious to buy. Both groups seem to be marking time waiting for the market to take a turn one way or another. The market cannot be called markedly weak. The softer prices merely reflect the comparative inactivity in copper. Foreign order have been fair, with the Continent the main buyer.

Average Metal Prices for September

Copper:	
New York Electrolytic	12.917
London Standard	62.750
London Electrolytic	67.125
Lead:	
New York	8.000
St. Louis	7.876
London	33.023
Silver:	
New York	69.350
London	34.832
Sterling Exchange	445.740
Zinc:	
St. Louis	6.181
London	32.926
Tin:	
99 per cent	48.595
Straits	49.095
London	243.511
Quicksilver	72.423
Antimony	11.022
Platinum:	
Refined	118.923
Crude	113.058

Lead Remains Firm

The official contract price of the American Smelting & Refining Co. continues at 8c. New York.

Lead shows no weakness and many elements of strength. Prices in New York and St. Louis have moved to a more normal relationship. No premiums have been obtained for lead in New York over 8c., while in St. Louis the metal was sold every day this week for 7.80c. Chicago is about 5 points above St. Louis. Sales at the end of September were fairly heavy in both New York and St. Louis, but the market has been quiet since Monday. Mixed-metal and ammunition business is reported to be doing well. Paint consumption is also good, and although the use of storage batteries has not increased by automobile manufacturers, other industries have compensated for this. The foreign market is exceedingly strong and taking all bonded lead from this country.

Zinc Steady

Domestic consumers have taken only a slight interest in the market, but the inquiry from abroad has kept the market from declining. Prime Western was sold generally for 6.15c. East St. Louis. The market has not fluctuated much either here or in London. The New York price is 35 points above St. Louis.

Tin Settles Down

The feature of the tin market has been the buying of tin in the United States by London dealers, the price here being below import cost. Demand has been light from domestic consumers.

Arrivals of tin in long tons for September, 4,985.

Silver Up to 70⅛c.

Silver has continued to advance, a new high for the year being established in both New York and London on Sept. 30, the quotations being 70⅛c. and 35 3/16d. respectively. The market is quiet.

Mexican Dollars.—Sept. 25th, 53¾c; 26th, 53¾c; 27th, 53¾c; 29th, 53⅞c; 30th, 54c; Oct. 1st, 54c.

Exchanges Moderately Active

The foreign exchanges have been firm. On Tuesday Sept. 30, francs were 5.29c., lire, 4.38c., and Canadian funds in Montreal, 1/32 per cent discount. in Montreal, 3/32 per cent discount.

Other Metals

Quotations cover large wholesale lots, f.o.b. New York, unless otherwise specified.

Aluminum—99 per cent, 28c. per lb.; 98 per cent, 27@28c.

London, 98 per cent, £125 long ton.

Antimony—Per lb.:

Chinese and Japanese brands, 11⅛@11¼c.

Cookson's "C" grade, 13¼@13½c.

Chinese needle, lump, nominal, 8½@9c.

Standard powdered needle, 200 mesh, 9@10c.

White oxide, Chinese, 99 per cent Sb_2O_3, 12@13c.

Bismuth—$1.85@$1.90 per lb. London, 7s. 6d.

Cadmium—60c. per lb. London, 2s. 6d.

Cobalt—$2.50@$3 per lb. Discounts on contracts. Oxide, $2.10@$2.25. London, 10s. for metal; 9s. for black oxide.

Germanium Oxide—25 to 50 gm. lots, $10 per gm.

Iridium—$260@$270 per oz. Nominal.

Iridium alloyed with platinum, $280@$286.

Magnesium—Sticks, 1⅛ in., 99.9 per cent, 90c.@$1 per lb. London quotes 3s. 3d. for 99 per cent.

[1]**Molybdenum**—99 per cent, $12 per lb.

Monel Metal—32c. per lb.

Nickel—Ingot, 29c.; spot, 30c.; electrolytic, 33c. (99.75 per cent grade).

New prices in effect, Oct. 1.

Osmiridium—Crude, $58.50 per oz.

Osmium—$95@$104 per troy oz.

Palladium—$80 per oz. Crude, $60 per oz. London, £19.

Platinum—Refined, $118 per oz.

Crude, $112@$114.

London, £26 10s. for manufactured.

Quicksilver — $71 per 75-lb. flask. San Francisco wires $71. London £12¾.

Radium—$70 per mg. radium content.

Rhodium—$85@$90 per oz.

Ruthenium—$40@$45 per oz.

Selenium — Black powdered, amorphous, 99.5 per cent pure, $2.10 per lb.

Tantalum—Metal, $400 per kg.

Tellurium—$2 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $8 per lb.

Tungsten Metal—Powder, 97 to 98 per cent, 95c.@$1 per lb. contained tungsten.

[1]**Zirconium Metal**—98 per cent grade, per lb., $30.

Metallic Ores

Chrome Ore—Per ton, c.i.f. Atlantic ports:

Indian, $18.50@$19.50.

Rhodesian, $21.50.

New Caledonian, $24.

Market nominal.

[1]**Galena Radio Crystals**—Best quality (50 per cent of sized fragments good) 50c. per lb. in 500-lb. lots, f.o.b. Philadelphia.

Iron Ore—Prices for iron ore and magnetite for 1924 season were published Aug. 9.

Manganese Ore — 41@45c. per long ton unit, seaport, plus duty. Nominal. Chemical grades[1], powdered, coarse or fine, 82@87 per cent MnO_2, Brazilian, Caucasian, and Javanese, $75@$80 per ton in carloads.

Molybdenum Ore—65@70c. per lb. of MoS_2 for 85 per cent MoS_2 concentrates. Nominal.

Pyrite Radio Crystals—(Best quality) $1.50 per lb. in 500-lb. lots.

Tantalum Ore—Foreign, 30@50c. per lb. of Ta_2O_5 contained, c.i.f. New York, according to quality.

Tungsten Ore—Per unit, N. Y.:

High-grade wolframite, $8.50@$8.75.

High-grade scheelite, $9.

Ordinary grades, $8.25@$8.50.

Market nominal.

Vanadium — Minimum 18 per cent V_2O_5, $1@$1.25 per lb. Nominal.

Lead Unchanged; Zinc Lower

Joplin, Mo., Sept. 27, 1924

Zinc Blende	Per Ton
High	$44.80
Premium, basis 60 per cent Zn	$42.00
Prime western, basis 60 per cent Zn	$41.00
Fines and slimes	$40@$38.00
Average settling price, all	$42.42

Lead Ore	
High	$110.55
Basis 80 per cent lead	$107.50
Average settling price, all	$106.32

Shipments for the week: Blende, 14,352; lead, 2,255 tons. Value, all ores the week, $847,570. Nine months' shipment: Blende, 531,512; calamine, 372; lead, 66,919 tons. Value, all ores nine months, $28,703,580.

One lot of premium was reported as receiving an offer of $43, and some high iron, otherwise Prime Western, sold on $42 basis. Low lead sold all the way from $42 to $43.

Platteville, Wis., Sept. 27, 1924

Zinc	Per Ton
Blende, basis 60 per cent zinc	$45.50

Lead	
Lead, basis 80 per cent lead	$112.00

Shipments for the week: Blende, 759 tons; lead, 40 tons. Shipments for the year: Blende, 23,090; lead, 800 tons. Shipments for the week to separating plants, 1,058 tons blende.

Non-Metallic Minerals

Prices received for non-metallic minerals vary widely and depend upon the physical and chemical characteristics of the commodity. Hence the following quotations can only serve as a general guide as to the prices obtained by producers and dealers in different parts of the United States for their own product. In the last analysis the value of a particular non-metallic mineral can only be ascertained by direct negotiation between buyer and seller.

[1]**Amblygonite**—8@9 per cent lithium oxide, $50@$60 per ton, f.o.b. mines.

Asbestos:

Crude No. 1—$300@$400.

Crude No. 2—$150@$200.

Spinning fibers—$90@$125.

Magnesia and compressed sheet fibers—$50@$80.

Shingle stock—$45@$55.

Paper stock—$30@$40.

Cement stock—$15@$25.

Floats—$9@$12.

Sand—$6@$8.

All per short ton, f.o.b. mines, Quebec, tax and bags included.

No. 1 Rhodesian crude, $280; No. 2, $175 per short ton, c.i.f. New York.

Barytes—Crude—$8.50 per ton, Missouri mines, 90@98 per cent $BaSO_4$; $9 per ton, f.o.b. Georgia mines; $6@$8, at Baltimore.

Ground—Off color, $13 per ton, Baltimore; white, $17, Baltimore.

Water ground and floated, bleached, $23@$24, f.o.b. St. Louis.

Operations about 70 per cent normal. Fair sized quantity of finished product on hand.

Bauxite—American, f.o.b. shipping point per gross ton:

Crushed and dried, $5.50@$8.75.

Pulverized and dried, $14.

Calcined, crushed, $19@$20.

Foreign, per metric ton c.i.f.:

French, 5 per cent SiO_2, $5@$7.

Dalmatian, low SiO_2, $5@$7.50.

Beryl—4½c. per lb. f.o.b. Connecticut points. Nominal.

$85 per ton, hand-sorted crystals, f.o.b. New York. Nominal.

Borax—Granulated and refined, crystals or powdered, in bags, carloads, 4¾c. per lb.; in bbls., 5c. Boric acid, 10½c.

[1]**Celestite**—90 per cent $SrSO_4$, finely powdered, $40 per ton in carload lots.

Chalk—F.o.b. New York, per lb.:

English, extra light, 5c.

Domestic, light, 4¼@4½c.

Domestic, heavy, 3½@3¾c.

In bulk, $5@$5.50 per ton.

China Clay (Kaolin)—F.o.b. Virginia mines, per short ton:

Crude No. 1, $7.

Crude No. 2, $6.

Washed, $8.50.

Powdered, $13@$20.

Powdered (Blue Ridge), $14@$20.

Imported English, f.o.b. American ports:

Lump, $15@$20.

Powdered, $45@$50.

1A grades, domestic, $16, f.o.b. mines.

Corundum — South African, $65 per ton, New York.

Diatomaceous Earth—Per short ton, f.o.b. plant, California:

Kiln-fired brick, $65.

Kiln-fired aggregate, ¼ in., $45.

Insulating powder, $30.

Natural aggregate, ¼ in., $20.

Air-floated powder, $40.

Emery—Per lb., f.o.b. plant:

Greek Naxos, 6½c.

Turkish, 6½c.

Khasia, 5½c.

American, 3½@4c.

Market fair.

[1]Price furnished by Foote Mineral Co., Philadelphia.

Feldspar—Per long ton, f.o.b. cars, *North Carolina:*
No. 1 pottery grade, $6.50@$7, depending upon quality.
No. 2 pottery grade, $4.50@$5, depending upon quality.
No. 1 soap grade, $6.75@$7.25.
Good market for best grade.

In *Connecticut*, per net ton, f.o.b. mines:
Pulverized, $17@$18.

In *New Hampshire*, per net ton, f.o.b. mines:
No. 1, not exceeding 10 per cent SiO_2, $7.50.
No. 2 pottery grade, $7.
Ground, $17@$20, f.o.b. mill.
Market fair.

In *New York*, per ton, f.o.b. cars:
No. 1, $8. Market dull.

In *Maine:*
No. 1 ground, $19. Market good.

In *Tennessee:*
Pottery grades, $15.30@$21.
Tile grades, $14@$18.
Enameling grades, $11@$16.
Crude, $7 for ordinary grades. As high as $7.25 offered for exceptional quality.
Demand increasing.

In *Canada:*
No. 1 crude, $7 per short ton.
No. 1 ground, 200 mesh, $25.

Fluorspar — F.o.b. Middle Western mines, per net ton:
Gravel, not less than 80 per cent CaF_2, and not over 5 per cent SiO_2, $17.50.
Gravel, not less than 85 per cent CaF_2 and not over 5 per cent SiO_2, $18.50.
Lump, not less than 85 per cent CaF_2, not over 5 per cent SiO_2, $18.50.
Ground, 93 to 98.5 per cent CaF_2 and not over 3 per cent SiO_2, $35 in bulk, $39 in bags or barrels.
Acid, ground, not less than 98½ per cent CaF_2 and not over 1 per cent SiO_2, $45 in bulk, $49 in packages.

Fuller's Earth—Per ton, f.o.b. Midway, Fla.:
16 to 30 mesh, $16.50.
16 to 60 mesh, $18.
30 to 60 mesh, $18.
60 to 100 mesh, $14.
Plus 100 mesh, $7.50.
Powdered, imported, duty paid, $23 @$25 per ton.

Garnet—Per short ton:
Spanish grades, $60, c.i.f. port of entry.
Domestic Adirondack, $85, f.o.b. shipping point.
Canadian, $70@$80, f.o.b. mines.

Gilsonite—Per ton, f.o.b. Colorado:
Jet asphaltum, $36.
Selects, $33.
Seconds (ordinary grades), $25.50.

Graphite—First quality, per lb.:
Ceylon lump, 6@6½c.
Ceylon chip, 5@5½.
Ceylon dust, 3½@4c.
Crude amorphous, $15@$35 per ton.
Flake, No. 1 and No. 2 from New York, 25@30c.
Ordinary flake, 8@15c.
Market unsettled. Prices low.

Gypsum—Per ton, depending upon source:
Crushed rock, $3@$4.50.
Ground, $3.50@$6.
Agricultural, $5@$7.
Calcined, $8@$16.

Ilmenite—Concentrates, 52 per cent TiO_2, 1½c. per lb., f.o.b. Virginia points. $25 per short ton, Florida mines.

Iron Oxide (See Ocher) — Ground, 95 per cent through 200 mesh, Standard Spanish red, $45 per ton.

Kaolin—See China Clay.

Lepidolite—$20@$30 per ton for ordinary grades.

Limestone—Depending upon source, f.o.b. shipping points; per ton:
Crushed, ¾ in. and less, $1.10@$1.70.
Crushed, 3 in. and larger, 90c.@$1.50.
Agricultural, $1.50@$5.

Magnesite—Per ton, f.o.b. California mines:
Calcined lump, 85 per cent MgO, $35.
Calcined ground, 200 mesh, $45.
Dead burned, $32@$34, Washington.
Dead burned, $40@$42, Chester, Pa.
Caustic calcined, Grecian, $50@$51, c.i.f., New York.

Manjak—Barbados, in 1 to 5 ton lots:
Grade "A," 6c. per lb.
Grade "AC," 7c. per lb.
Grade "AA," fine, 8c. per lb.
Grade "C," fine and lump, 9c.
Grade "C," lump, 12c.

Mica—
North Carolina prices:
Scrap, $17@$20 per ton.
Sheet, per lb., No. 1 quality, clear:
Punch, 1¼ in., 7c.

1½ x 2 in., 16c.	3 x 4 in., $1.75.
2 x 2 in., 30c.	3 x 5 in., $2.35.
2 x 3 in., 75c.	4 x 6 in., $3.
3 x 3 in., $1.25.	6 x 8 in., $4.50.

Ground, 60 mesh, $65 per ton.
Ground, 80 mesh, $70.
Ground, 120 mesh, $120.
Ground, 140 mesh, $125.
Dry ground, roofing, $27.50.
Dry ground, 80 mesh, $32.50.
Dry ground, 100 mesh, $55.00.
Dry ground, 160 mesh, $70.00.

In *New Hampshire:*
Washer and disk, $320 per ton.
Scrap, $24 per ton.

[1]Monazite—Minimum 6 per cent ThO_2, 6@8c. per lb.

Ocher—"Yellow Peruvian," $25@$30 per ton, Georgia mines.

Ozocerite—Per lb. in bags, New York:
Black, 160 deg. melting point, 26@27c.
Green, 170 deg. melting point, 28@29c.

Phosphate — Per long ton, f.o.b., *Florida* export prices:
76@77 per cent, pebble, $5.75.
75 per cent, $5.50.
74@75 per cent, $5.25.
70 per cent, $3.50.
68 per cent, $3.
In *Tennessee*, per long ton:
75 per cent hand-mined lump, $6.75 @$7.
75 per cent washed lump, $7.
72 per cent washed run of mine, $5.75.
65 per cent ground 95 per cent through 100 mesh, $7 per short ton.

Potash—Contract prices, per ton:
Kainit, 14@16 per cent, $7.33.

Pumice Stone—Imported lump, 3@40c. per lb.

[1]Price furnished by Foote Mineral Co., Philadelphia.

Powdered, in bbl., 3@5c.
Lumps, in bbl., 6@8c.

Pyrites—Tharsis, per long ton unit, c.i.f. U. S. ports:
Furnace size, 12c.
Lump, 11c.
Fines, through ¾ in., 11½c.
Cinder from ore to remain property of buyers.
Market quiet.

Quartz Rock Crystals — Colorless, clear and flawed, pieces, ¾ to 3 lb. in weight, 40c. per lb. in ton lots.
For optical purposes, double above prices.

Rutile—F.o.b. Virginia points, per lb.:
Granular, 94@96 per cent TiO_2, 12@15c.
Pulverized, 100 mesh, 94@96 per cent, 17@30c.
93 per cent TiO_2, 11c., Florida, delivered.

Silica—Water ground and floated, per ton, f.o.b. Illinois:
450 mesh, $31@$34.
350 mesh, $25@$28.
250 mesh, $23.
200 mesh, $20.
100 mesh, $8.
Glass sand, $2@$2.25 per ton; brick and molding sand, $2@$2.25.

Spodumeme—$20@$30 per ton, depending upon lithium content. Nominal.

Sulphur—$16@$18 per ton for domestic, f.o.b. Texas and Louisiana mines; $18@$20 for export, f.a.s New York.

Talc—Per ton, in 50-lb. paper bags, *Vermont* mills, carloads:
Ground, 200 mesh, extra white, $10.50.
Ground, 180 mesh, medium white, $10.
Ground, 160 mesh, medium white, $9.50.
Prices firm with slight advancing tendency.

In *New York*, double air-floated, including containers:
200 mesh, $13.75.
325 mesh, $14.75.
100 mesh, $11, not air-floated.
Demand fair.

In *California*, $20@$30 per ton, ground.

In *Georgia*, powdered, per ton:
Gray or yellow, $7.50@$10.
Red or white, $10@$14.
Market good for powders.
White, $12@$15.
Grayish white, $8@$10.
Red, $12@$14.
Yellow, $8@$12.
Roofing, $7.50@$8.
Improved market.

Tripoli—Per short ton, burlap bags, paper liners, per minimum carload 30 tons, f.o.b. Missouri:
Once ground:
Rose and cream colored, $16@$25.
White, $18@$27.
Double ground:
Rose and cream, $17@$25.
White, $19@$30.
Air-float:
Rose and cream, $25@$30.
White, $35.
Market steady.

Zircon—Freight allowed east of Mississippi River:
99 per cent, 6c. per lb., f.o.b. Florida.
Powdered, 7c. per lb., f.o.b. Florida.

Mineral Products

Arsenious Oxide (white arsenic)—7c. per lb.

Copper Sulphate—4.70c. per lb.

Potassium Sulphate—Basis 90 per cent, $45.85 per ton.

Sodium Nitrate—$2.50 per 100 lb., ex vessel Atlantic ports.

Sodium Sulphate—$16@$18 per ton, New York.

Zinc Oxide—Per lb. in bags:
Lead free, 7⅝c.
5 per cent lead sulphate, 6⅞c.
10 to 35 per cent lead sulphate, 6⅝c.
French, red seal, 9⅝c.
French, green seal, 10⅝c.
French, white seal, 11⅞c.

Ferro-Alloys

[1]**Ferrocerium**—$7 per lb.

Ferrochrome—1 to 2 per cent carbon, 30c. per lb.; 4 to 6 per cent carbon, 10⅝c. per lb.

Ferromanganese — Domestic, 78@82 per cent, $92.50@$95 per gross ton, f.o.b. furnace. Spiegeleisen, 19@21 per cent, $32, f.o.b. furnace; 16@19 per cent, $31.

Ferromolybdenum—$1.80 per lb. of contained molybdenum for 50 to 55 per cent grades.

Ferrosilicon—10 to 12 per cent, $39.50 @$43.50 per gross ton, f.o.b. works; 50 per cent, $72@$75 delivered.

Ferrotitanium—For 15 to 18 per cent material, $200 per ton, f.o.b. Niagara Falls, N. Y.

Ferrotungsten — 88@90c. per lb. of contained W, f.o.b. works. Quiet.

[1]**Ferro-uranium**—35 to 40 per cent U, $4.50 per lb. of U contained, f.o.b. works.

Ferrovanadium—$3.25@$3.50 per lb. of V contained, f.o.b. works.

Metal Products

Rolled Copper—Sheets, 20½c.; wire, 15½c.

Lead Sheets—Full lead sheets, 10¾c. per lb.; cut lead sheets, 11c. in quantity, mill lots.

Nickel Silver—26½c. per lb. for 18 per cent nickel Grade A sheets.

Yellow Metal — Dimension sheets, 17⅞c. per lb.; rods, 14⅞c. per lb.

Zinc Sheets—9.85c. per lb., f.o.b. works.

Refractories

Bauxite Brick—$140@$145 per M., Pittsburgh, Pa.

Chrome Brick—$45@$47 per net ton, f.o.b. shipping point.

Firebrick—First quality, $40@$43 per M., Ohio, Kentucky, Central Pennsylvania; second quality, $33@$37.

Magnesite Brick — 9-in. straights, $65 per net ton, f.o.b. works.

[1]Price furnished by Foote Mineral Co., Philadelphia.

Magnesite Cement—$47@$50 per net ton, f.o.b. Chester, Pa.

Silica Brick—$33@$35 per M. Pennsylvania; $48@$50 Alabama.

Zirkite—Powdered, 80 per cent ZrO_2, 5c. per lb.; 70 per cent, 2½c. per lb. Brick, straights, 75@95c. each.

Iron Trade Still Dull

Pittsburgh, Sept. 30, 1924.

There is considerable uncertainty as to steel prices in various districts, on account of the development of new systems of determining delivered prices following the recent abandonment of the "Pittsburgh plus" system, but this has not slowed down buying to any great extent, as buying was of hand-to-mouth character and could not be suspended.

Pig Iron—Foundry iron has lost the $1 advance it scored five weeks ago, other grades being unchanged. Bessemer, $20; basic, $19; foundry, $19.50 @$20, f.o.b. Valley furnaces.

Connellsville Coke—The market is dull. The only feature is that sellers' price views are somewhat stiffened by increasing operations at the Frick plants, which may possibly make it difficult for the independents to maintain their much lower wage scale. Spot furnace, $3@$3.10; contract, $3.25, spot foundry, $4@$4.50.

Company Reports

Lake Shore Mines

Gold; Kirkland Lake, Ont.

A report covering the operations at the Lake Shore Mines, Ltd., for the year ended June 30, 1924, states that production totaled 24,223 tons milled, yielding bullion worth $578,242.50. Dividends totaled $160,000, net profit being $105,796.

Balance Sheet as at June 30, 1924

Assets

Cash and bank balances	$72,439.17	
Bullion products on hand	50,571.79	
Accounts receivable	692.90	
Supplies on hand	41,742.44	
Bonds, Dominion of Canada	202,325.32	$367,771.62
Buildings, structures and equipment	$576,680.50	
Less depreciation	216,721.26	359,959.24
Mining properties	$1,222,638.00	
Less provision for exhaustion	700,000.00	522,638.00
Insurance reserve fund		15,459.52
Sundry assets and prepaid expense		3,330.34
		$1,269,158.72

Liabilities

Accounts payable		$25,638.94
Salaries and wages		7,182.62
Accrued charges		9,902.63
Provision for Dominion Government taxes		15,000.00
Insurance reserve		$57,724.19
Capital stock	$2,000,000.00	15,459.52
Less discount on shares	667,797.00	
	$1,332,203.00	
Profit and loss (debit) balance, brought forward July 1, 1923	$82,024.61	
Dividends Nos. 14, 15, 16, 17	160,000.00	
	$242,024.61	
Net profit for period	105,796.62	
	136,227.99	
		1,195,975.01
		$1,269,158.72

Profit-and-Loss Account

Income

Bullion production	$578,242.59		
Exchange on bullion sales	11,877.39		
		$590,119.98	
Interest		12,847.97	$602,967.95

Expenses

Operating	$295,862.35		
Administrative	19,373.75	$315,236.10	
Provision for depreciation	$48,446.75		
Exhaustion of mine	120,000.00		
Dominion Government taxes	14,674.62	183,121.37	498,357.47
Profit for period			$104,610.48
Profit realized on sale of Victory bonds			1,186.14
Balance carried forward, asset out on balance sheet			$105,796.62

Santa Gertrudis Co., Ltd.

A report of the working operations of the Santa Gertrudis mines for the quarter ended June 30, 1924, states that the mill, during this period, crushed 8,396 dry, short tons of ore from the Santa Gertrudis mine. The financial statement in United States currency, is as follows:

Value of bullion produced	$68,319
Less working expenses (including development, shipping, and selling	49,520
Estimated profit at mines	$18,799

Transvaal Gold Output

The production of gold from the mines of the Transvaal in August, 1924, was 809,571 fine ounces, and compares with 829,437 ounces in July and 769,371 ounces in August, 1923. The following table gives the monthly outputs since the beginning of 1920:

	1920 Fine Oz.	1921 Fine Oz.	1922 Fine Oz.	1923 Fine Oz.	1924 Fine Oz.
January	670,503	651,593		764,469	796,768
February	625,330	558,137	639,728	704,970	760,617
March	707,036	671,123		761,586	795,671
April	686,979	681,382	511,338	743,651	768,923
May	699,041	687,776	629,786	786,564	809,003
June	715,957	678,490	675,697	755,309	773,053
July	736,099	689,555	730,635	754,306	829,437
August	702,083	711,526	752,490	769,371	809,571
Total (8 months)	5,543,028	5,329,582	3,939,674	6,040,226	6,343,043
September	682,173	691,026	747,089	739,504	.....
October	662,472	707,825	778,159	793,842	.....
November	633,737	704,236	764,476	780,639	.....
December	632,215	681,847	790,712	778,849	.....
Total (12 months)	8,153,625	8,114,516	7,020,110	9,133,060	.....

Metal Statistics

Monthly Average Prices of Metals

Silver

	New York		London		Sterling Exchange	
	1923	1924	1923	1924	1923	1924
January	65.668	63.447	31.928	33.549	465.053	425.524
February	64.313	64.359	30.875	33.565	468.631	430.457
March	67.556	63.957	32.310	33.483	469.269	428.769
April	66.855	64.139	32.346	33.065	465.220	434.788
May	67.043	65 524	32.611	33.870	462 252	435 716
June	64.861	66.690	31.611	34.758	461.132	431.675
July	63.015	67.159	30.942	34.509	458.025	436.649
August	62.793	68.519	30.952	34.213	455.714	449.510
September	64.203	69.350	31.698	34.832	453.901	445.740
October	63.649	.....	31.718	.....	452.024	.....
November	63.818	.....	32.774	.....	437.839	.....
December	64.705	.....	33.375	.....	435.500	.....
Year	64.873	.....	31.929	.....	457.047	.....

New York quotations, cents per ounce troy, 999 fine, foreign silver. London, pence per ounce, sterling silver, 925 fine.

Copper

	New York		London			
	Electrolytic		Standard		Electrolytic	
	1923	1924	1923	1924	1923	1924
January	14.510	12.401	64.494	61.273	71.409	67.193
February	15.355	12.708	67.700	63.113	74.500	68.167
March	16.832	13.515	73.851	66.137	81.464	72.087
April	16.663	13.206	73.169	64.338	81.331	70.150
May	15.440	12.772	67.460	62.006	76.568	67.648
June	14.663	12.327	66.607	61.375	73.238	66.313
July	14.321	12 390	65.278	61.652	72.364	65.815
August	13.822	13.221	64.034	63.481	70.000	67.800
September	13.323	12.917	63.194	62.750	68.275	67.125
October	12.574	.....	60.614	.....	64.250	.....
November	12.727	.....	61.648	.....	66.477	.....
December	12.823	.....	62.035	.....	67.611	.....
Year	14.421	.....	65.840	.....	72.291	.....

New York quotations, cents per lb. London, pounds sterling per long ton.

Lead

	New York		St. Louis		London	
	1923	1924	1923	1924	1923	1924
January	7.633	7.972	7.571	8.002	27.119	31.528
February	8.050	8.554	8.093	8.643	28.519	34.589
March	8.252	9.013	8.254	8.891	28.815	37.161
April	8.101	8.263	7.996	7.932	26.956	32.819
May	7.306	7.269	7.085	6.973	25.614	29.426
June	7.146	7.020	6.852	6.848	25.429	32.138
July	6.237	7.117	6.126	6.886	24.188	32.916
August	6.582	7.827	6.496	7.764	24.222	32.744
September	6.856	8.00	6.700	7.876	25.688	33.023
October	6.831	.....	6.570	.....	27.815	.....
November	6.846	.....	6.582	.....	30 352	.....
December	7.369	.....	7.369	.....	31.042	.....
	7.267	.....	7.141	.....	27.147	.....

New York and St. Louis quotations, cents per lb. London, pounds sterling per long ton.

Tin

	New York				London	
	99%		Straits			
	1923	1924	1923	1924	1923	1924
January	37.986	48.250	39.173	48.750	181.852	246.790
February	40.693	52.772	42.011	53.272	190.513	272.399
March	46.569	54.370	48.569	54.870	219.607	277.429
April	44.280	49.457	45.810	49.957	213.081	250.863
May	42.346	43.611	43 135	44.111	203.097	218.511
June	40.375	42.265	40.957	42.765	191.798	219.219
July	37.970	45.750	38.490	46.250	181.188	233.332
August	38.841	51.409	39.269	51.909	186.705	254.638
September	41.047	48.595	41.547	49.095	198.263	243.511
October	41.322	.....	41.851	.....	203.957	.....
November	43.495	.....	43.995	.....	220.710	.....
December	46.662	.....	47.160	.....	235.007	.....
Year	41.799	.....	42.664	.....	202.148	.....

New York quotations, cents per lb. London, pounds sterling per long ton.

Zinc

	St. Louis		London	
	1923	1924	1923	1924
January	6.815	6.426	35.733	34.761
February	7.152	6.756	35.613	36.518
March	7.706	6.488	36.720	35.298
April	7.197	6.121	34.275	32.588
May	6.625	5.793	31.057	30.648
June	6.031	5.792	29.548	31.783
July	6.089	5.898	29.335	32.193
August	6.325	6.165	32.386	32.544
September	6.438	6.181	33.469	32.926
October	6.293	.....	32.995	.....
November	6.347	.....	32.949	.....
December	6.260	.....	32.611	.....
Year	6.607	.....	33.058	.....

St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Antimony, Quicksilver and Platinum

	Antimony (a) New York		Quicksilver (b) New York		Platinum (c) Refined New York		Platinum (c) Crude New York
	1923	1924	1923	1924	1923	1924	1924
January	6.884	10.279	72.731	59.500	112.462	122.115	115.500
February	7.290	10.935	70.636	59.565	113.273	124.739	115.935
March	8.885	11.442	70.808	64.269	110.846	121.692	113.231
April	8.380	9.952	69.200	74.308	116.840	115.577	108.077
May	7.477	8.755	68.000	76.962	115.007	115.731	112.192
June	6.839	8.403	67.769	73.720	115.615	116.000	113.000
July	7.097	8.477	66.980	72.173	116.000	118.231	113.865
August	7.753	9.839	65.212	72.096	116.000	120.000	113.500
September	7.633	11.022	63.000	72.423	116.000	118.923	113.058
October	8.005	.....	61.769	.....	116.923	.....	.....
November	9.156	.....	61.917	.....	124.479	.....	.....
December	9.365	.....	60.000	.....	125.000	.....	.....
Year	7.897	.....	66.502	.....	116.537	.....	.....

(a) Antimony quotations in cents per lb. for ordinary brands. (b) Quicksilver in dollars per flask. (c) Platinum in dollars per ounce.

Pig Iron, Pittsburgh

	Bessemer		Basic		No. 2 Foundry	
	1923	1924	1923	1924	1923	1924
January	29.27	24.76	27.35	23.76	28.77	23.88
February	29.79	25.26	28.15	23.76	27.21	25.06
March	32.03	25.14	31.79	23.76	31.77	24.76
April	32.77	24.56	32.77	23.26	32.77	23.80
May	31.87	23.89	29.83	22.08	32.46	22.91
June	30.27	.....	28.34	.....	29.81	.....
July	28.47	.....	26.52	.....	27.47	.....
August	28.27	21.76	26.77	20.76	26.77	20.99
September	28.26	.....	26.26	.....	26.72	.....
October	26.96	.....	25.01	.....	25.52	.....
November	24.79	.....	22.57	.....	23.60	.....
December	24.54	.....	22.62	.....	23.72	.....
Year	28.94	.....	27.33	.....	28.05	.....

In dollars per long ton.

Monthly Crude Copper Production

Domestic

	1924			
	May	June	July	August
Alaska shipments	6,375,469	6,314,241	9,949,406	138,760
Calumet & Arizona	3,332,000	2,346,000	2,732,000	3,802,000
Miami	5,314,000	5,439,000	4,806,000	5,108,000
New Cornelia	4,505,996	4,651,589	4,427,373	5,627,261
Old Dominion	2,000,000	1,715,000	2,321,000	2,455,000
Phelps Dodge	10,527,000	10,925,000	12,248,000	12,341,000
United Verde Extension	3,500,000	3,579,448	3,474,178	4,011,746
A.S. & R. & Tenn. Copper	17,500,000	17,000,000	18,500,000	12,000,000
Imports: Ore and concentrates, matte	16,882,662	13,796,247	10,037,156	.....
Partly from				
Chile	4,737,728	6,874,522	3,514,581	.....
Cuba	1,848,000	.....	2,537,920	.....
Canada	2,443,598	4,043,342	282,689	.....
Mexico	3,458,972	1,798,738	2,084,239	.....
Imports of black and blister, unrefined	36,563,022	52,698,756	36,245,999	.....
Partly from				
Chile	14,657,052	13,616,153	12,405,405	.....
Peru	4,302,661	8,973,871	5,427,330	.....
Africa	.....	16,680,456	8,512,932	.....
Mexico	6,286,999	7,802,748	3,599,039	.....
Imports of refined and old	8,970,467	14,595,751	17,102,388	.....

Foreign

Boleo, Mexico	1,801,485	1,375,201	1,314,275	1,258,030
Falcon Mines, Rhodesia	482,000	468,000	466,000	.....
Furukawa, Japan	2,825,240	2,370,647	2,601,374	.....
Cons. M & S., Canada	400,000	590,000	674,000	416,865
Granby Cons., Canada	2,892,869	3,076,770	3,120,904	2,238,146
Katanga, Africa	13,940,010	15,807,643	18,861,570	20,411,685
Mount Morgan, Aust.	800.000	894,000	916.000	.....
Mount Lyell, Aust.	1,600.000	668,000	750,000	.....
Phelps Dodge Mexican	2,547,000	2,783,000	4,002,000	3,292,000
Sumitomo, Japan	2,394,132	2,797,577	3,004,986	2,519,542

Comparative U. S. Copper Mine Production

	1921	1922	1923	1924
January	90,596,597	32,010,292	112,267,000	133,356,000
February	86,682,941	45,957,530	102,725,000	128,260,000
March	91,046,345	55,705,760	121,562,000	129,816,000
April	46,946,523	76,601,000	118,157,000	131,928,000
May	25,310,511	88,714,000	125,438,000	130,644,000
June	24,623,693	93,740,000	125,479,000	126,948,000
July	22,033,739	91,000,000	125,249,000	.....
August	23,248,398	101,188,000	131,088,000	.....
September	23,855,316	96,408,000	124,523,000	.....
October	23,231,572	103,273,000	132,481,000	.....
November	28,341,442	102,845,000	127,963,000	.....
December	26,629,137	103,003,000	129,354,000	.....

(a) Not available.

Mining Stocks

Week Ended September 27, 1924

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Alaska-Br. Col.	N. Y. Curb	...	...	*37	...	....
Anaconda	New York	38¼	36¼	37⅜	De.15, Ja.21, Q	0.75
Arcadian Consol.	Boston	1⅜	1¼	1¼	...	....
Aris. Com'l.	Boston	10¼	10	10¼	Jy.19, Jy.31	0.50
Calaveras	N. Y. Curb	...	...	2	...	....
Calumet & Arizona	Boston	52¼	51	51	Se. 5, Se. 22 Q	0.50
Cal. & Hecla (New)	Boston	15⅛	15⅛	15⅛	My. 31, Jn. 16	0.50
Canario Copper	N. Y. Curb	4	3½	3⅝	...	....
Cerro de Pasco	New York	46½	45⅜	46	Jy. 17, Au. 1	1.00
Chile Copper	New York	33⅜	32⅛	32⅛	Se.3, Se.29, Q	0.62½
Chino	New York	19⅜	19¼	19½	Sept., 1920,	0.37½
Con. Coppermines	N. Y. Curb	3⅛	3¼	3¼	...	....
Copper Range	Boston	24⅞	22⅛	23¼	May, 1923	1.00
Crystal Copper	Boston Curb	*61	*54	*58	...	....
Davis-Daly	Boston	*45	*42	*42	Mar., 1920	0.25
East Butte	Boston	4⅛	3¾	4	Dec., 1919	0.50
First National	Boston Curb	*38	*36	*36	Feb., 1919,	0.15
Franklin	Boston	*65	*40	*65	...	....
Gadsden Copper	Boston Curb	*60	*59	*60	...	....
Granby Consol.	New York	19½	18	18½	May, 1919	1.25
Greene-Cananea	New York	15⅜	15⅛	15⅜	Nov., 1920	0.50
Hancock	Boston	...	...	1⅛	...	....
Howe Sound	N. Y. Curb	2⅛	2⅛	2⅛	Ap.1, Ap.15, Q	0.05
Inspiration Consol.	New York	25⅛	25⅛	25⅛	De.20, Ja.7, Q	0.50
Iron Cap	Boston Curb	2⅛	2⅛	2⅜	May, 1923	0.15
Isle Royale	Boston	16	15	15⅛	Se. 1, Se. 15,	0.50
Jerome Verde Dev.	N. Y. Curb	1	1	1	...	....
Jib Consol	N. Y. Curb	*67	*55	*60	...	....
Kennecott	New York	48¼	47⅛	47¼	Se.5, Oc.1, Q	0.75
Keweenaw	Boston	*75	*60	*75	...	....
Lake Copper	Boston	2	1⅛	1⅛	...	....
Magma Copper	New York	36¼	35⅛	35⅛	Jan., 1919	0.50
Mason Valley	N. Y. Curb	1⅛	1⅛	1⅛	...	....
Mass Consolidated	Boston	1⅛	1	1	Nov., 1917	1.00
Miami Copper	New York	27⅛	21⅛	21⅝	Au.1, Au.15, Q	0.15
Mohawk	Boston	34	31⅛	31⅛	Se. 22, Oc. 13,	1.00
Mother Lode Coa.	New York	8¼	7⅛	7⅛	Jn.13, Jn.30	0.37½
Nevada Consol.	New York	14	14	14	Sept., 1920,	0.25
New Cornelia	Boston	21	20	20	Au.8, Au.25,	0.25
New Dominion	N. Y. Curb	...	...	2⅛	...	....
North Butte	Boston	4⅜	4 1/16	4 1/16	Oct., 1918,	0.25
Ohio Copper	N. Y. Curb	1⅛	1⅛	1⅛	...	....
Old Dominion	Boston	20⅜	20	20⅜	Dec., 1918	1.00
Phelps Dodge	Open Mar.	†117	†113	...	Se.20, Oc.1 Q	1.00
Quincy	Boston	22	20	20	Mar., 1920	1.00
Ray Consolidated	New York	12⅛	12	12⅛	Dec., 1920	0.25
Ray Hercules	N. Y. Curb	*20	*20	*20	...	....
St. Mary's Min. Ld.	Boston	36⅛	34	34⅞	Ap.22, My.20	3.00
Seneca Copper	New York	1⅜	1⅛	1⅜	...	....
Shannon	Boston	1	*85	*85	Nov., 1917	0.25
Shattuck Arizona	New York	6½	6⅜	6⅜	Jan., 1920	0.25
Superior & Boston	Boston	1 1/16	1⅛	1⅛	...	....
Tenn. C. & C. cfs.	New York	8	7⅞	7⅞	De.31, Ja.15, Q	0.25
United Verde Ex	N. Y. Curb	26⅛	25⅞	26	Oc.3, No.1	0.50
Utah Copper	New York	78⅛	77⅛	77⅛	Se.15, Se.30, Q	1.00
Utah Metal & T.	Boston	*29	*25	*25	Dec., 1917	0.30
Victoria	Boston	...	...	50	...	....
Walker Mining	N. Y. Curb	3	3	3	...	....
Winona	Boston	*37	*37	*37	...	....
NICKEL-COPPER						
Internat. Nickel	New York	18⅛	17⅞	18⅛	Jy.17, Au.1, Q	1.50
Internat. Nickel pfd.	New York	88⅝	88	88⅝	Jy.17, Au.1, Q	1.50
LEAD						
Carnegie Lead & Zinc	Pittsburgh	3⅞	3⅞	3⅞	...	....
National Lead	New York	160½	156	157⅞	Se.12, Se.30, Q	2.00
National Lead pfd.	New York	...	...	118	Au. 22, Se. 15, Q	1.75
St. Joseph Lead	New York	30⅛	28⅞	30⅛	Se. 9, Se.20	0.50
ZINC						
Am. Z. L. & S.	New York	8	7	7	May, 1920	1.00
Am. Z. L. & S. pfd.	New York	28	28	28	Nov., 1920	1.50
Butte C. & Z.	New York	6	5⅛	5⅛	Mar., 1923	0.50
Butte & Superior	New York	17	16⅛	16⅛	Je.15, Je. 30, Q	0.50
Callahan Zn-Ld.	New York	3½	3¼	3¼	Dec., 1920	0.50
New Jersey Zn.	N. Y. Curb	161	160	161	Oc.,No.,'24 QX	4.00
United Zinc	N. Y. Curb	...	...	*25	...	....
Yellow Pine	Los Angeles	...	...	56	June, 1924	0.04
SILVER						
Alvarado	N. Y. Curb	...	...	*90	...	....
Beaver Consol.	Toronto	*16½	*16	*16½	May, 1920	0.03
Castle-Trethewey	Toronto	*71	*67½	*70	...	....
Coniagas	Toronto	1.80	1.80	1.80	Ap.20, My.1	0.02½
Crown Reserve	Toronto	*48	*46	*47	Jan., 1917	0.05
Keeley	Toronto	2.25	2.23	2.24	Sept. 15, SA	0.12
Kerr Lake	N. Y. Curb	2⅛	1⅞	2⅛	Oc. 1, Oc. 15,	0.12½
La Rose	Toronto	*8	*8	*8	Apr., 1922	0.10½
Lorrain Trout Lake	Toronto	1.45	1.45	1.45	...	....
McKinley-Dar.-Sav.	Toronto	*14	*11½	*12	Oct., 1920	0.03
Mining Corp. Can.	Toronto	2.74	2.65	2.70	Sept., 1919	0.12½
Nipissing	N. Y. Curb	6¼	6⅛	6⅛	Oc.1, Oc.20, QX	0.30
Ontario Silver	New York	...	...	6⅜	Jan., 1919	0.50
Temiskaming	Toronto	*20	*20	*20	Jan., 1920	0.40
GOLD						
Alaska Gold	New York	*12⅛	*12⅛	*12⅛	...	....
Alaska Juneau	New York	1⅛	1⅛	1⅛	...	....
Argonaut	Toronto	*35	*30¼	*34	...	....
Carson Hill	Boston	1¼	1	1¼	...	....
Cresson Consol. G	N. Y. Curb	3⅜	3⅛	3⅛	Jn.30, Jy.10, Q	0.10
Dome Mines	New York	15⅞	15⅝	15⅝	Oc.3, Oc.20, Q	0.50
Golden Cycle	Colo. Springs	1.26	1.25	1.25	My.31, Jn.10 Q	0.03
Hollinger Consol.	Toronto	14.85	14.65	14.75	Se.18, Oc.6, M	0.05
Homestake Mining	New York	46	46	46	Se.20, Se.25, M	0.50
Kirkland Lake	Toronto	*19	*18⅜	*18⅜	...	....
Lake Shore	Toronto	3.86	3.84	3.85	Se.1, Se.15, Q	0.05
McIntyre-Porcupine	New York	16⅛	15⅜	15⅜	Au. 1, Se. 1,	0.25
Newray	Toronto	*24⅛	*23⅛	*24	...	....
Portland	Colo. Springs	48	48	48	Oct., 1920	0.01
Teck-Hughes	Toronto	1.25	1.24	1.24	...	....
Tom Reed	Los Angeles	19	18½	18½	Dec., 1919	0.02
Tough-Oakes	Toronto	*61½	*59¾	*61	...	....
United Eastern	N. Y. Curb	...	...	*43	Jy 18, Jy.31, Q	0.05
Vipond Cons.	Toronto	1.30	1.27	1.29	...	....
Wright-Hargreaves	Toronto	3.75	3.65	3.70	Se.15, Oc. 1, Q	0.02½
GOLD AND SILVER						
Black Oak	N. Y. Curb	...	...	*89	...	....
Con. Cortez	N. Y. Curb	*13	*10	*13	...	....
Con. Virginia	San Francisco	7½	6½	6½	...	....
Continental Mines	N. Y. Curb	...	...	2¼	...	....
Dolores Esperanza	N. Y. Curb	...	...	*50	Jy. 1, Jy. 10 Q	0.05
Premier Gold	N. Y. Curb	2⅛	2⅛	2⅛	Se.25, Oc 30	0.08
Tonopah Belmont	N. Y. Curb	*62	*58	*58	Apr., 1923	0.05
Tonopah Divide	N. Y. Curb	*26	*24	*24	Se.22, Oc. 10	0.10
Tonopah Extension	N. Y. Curb	3 5/16	3⅛	3 1/16	Se. 10, Oc. 1	0.05
Tonopah Mining	N. Y. Curb	2	2	2	Se. 30, Oc. 21	0.07½
Unity Gold	N. Y. Curb	1⅞	1⅞	1⅞	...	....
West End Consol.	N. Y. Curb	*70	*66	*67	Mar., 1923	0.05
Yukon Gold	N. Y. Curb	...	...	*50	June, 1918	0.02
SILVER-LEAD						
Ahumada	Boston Curb	6⅞	6⅝	6⅝	Se.16, Oc. 2, X	0.15
Bingham Mines	Boston	16½	16½	16½	Sept, 1919	0.25
Cardiff M. & M.	Salt Lake	*75	*75	*75	Dec., 1920	0.15
Chief Consol.	Boston Curb	2⅞	2⅞	2⅞	Ap.19, My.1, Q	0.10
Columbus Rexall	Salt Lake	26	21	26	Aug., 1920	0.03
Consol. M. & S.	Montreal	44	43¼	43½	Jn.30, Jy.15	0.75
Daly Mining	Salt Lake	...	...	2.00	July, 1920	0.10
Erupcion	Boston Curb	...	...	2½	Se. 15, Oc.2, X	0.15
Federal M. & S.	New York	...	...	12⅝	Jan., 1909	1.50
Federal M. & S. pfd.	New York	51	49½	50	Au.25, Se.15, Q	1.75
Florence Silver	Spokane	7⅜	5⅞	5⅞	Apr., 1919, QX	0.01
Hecla Mining	N. Y. Curb	9¼	9⅛	9¼	Sept. 15, 1924	0.25
Iron Blossom Con.	N. Y. Curb	...	...	*21	Oct., 1923	0.02
Marsh Mines	N. Y. Curb	...	...	*5	June, 1921	0.02½
Park City	Salt Lake	...	...	4.45	Se.15, Oc.1,	0.15
Park Utah	N. Y. Curb	...	...	3½	Mc.15, Ap.1	0.15
Prince Consol.	Salt Lake	*7⅛	*7⅛	*7⅛	Nov., 1917	0.02
Silver King	N. Y. Curb	...	...	*50	Se.20, Oc.1,	0.15
Silversmith	Spokane	*32	*30½	*32	Jy.1, Jy. 10,	0.01
Tamarack-Custer	Spokane	1.45	1.40	1.40	Se.22, Se 29,	0.25
Tintic Standard	Salt Lake	6.40	6.25	6.25	Se.1, '24, X	0.25
Utah-Apex	Boston	2⅛	2	2⅛	Se.5, Se.15, Q	0.25
IRON						
Bethlehem Steel	New York	45½	42⅞	43½	Jn.1, Jy.1, Q	1.25
Char. Iron	Detroit	*33	*33	*33	...	....
Char. Iron pfd.	Detroit	*85	*85	*85	...	....
Colorado Fuel & Iron	New York	45¼	41⅛	43	Au.11, Au. 25 Q	2.00
Col. Fuel & Iron pfd.	New York	...	...	108½	Feb., 1923	2.00
Gt. North'n Iron Ore	New York	29¾	29	29⅜	De.10, De.27	2.00
Inland Steel	N. Y. Curb	...	...	46	Au.15, Se.1 Q	0.62½
Mesabi Iron	N. Y. Curb	...	...	2¾	...	....
Replogle Steel	New York	12⅞	10⅞	12	...	....
Republic I. & S.	New York	48⅛	45⅝	46⅛	May, 1921	1.50
Republic I. & S. pfd.	New York	85⅞	85⅝	85⅝	Se.15, Oc.1, Q	1.75
Sloss-Sheffield S.&I.	New York	74⅛	73	73⅞	Se.11, Se.20, Q	1.50
Sloss-Shef. S.&I.pfd.	New York	...	...	89	Se.20, Oc.1, Q	1.75
U. S. Steel	New York	109⅜	107⅞	109⅛	Se.1, Se.29 QX	1.75
U. S. Steel pfd.	New York	122⅛	122⅛	122½	Au. 5, Au. 30 Q	1.75
Virginia I. C. & C.	New York	...	...	37½	De.15, Ja. 2	1.50
Virginia I.C.&C.pfd.	New York	...	...	71	Jn.17, Jy.1	2.50
VANADIUM						
Vanadium Corp.	New York	26⅛	25	25	Jan., 1921	1.00
ARSENIC						
Western Utah Copper	N. Y. Curb	*15	*15	*15	...	....
ASBESTOS						
Asbestos Corp.	Montreal	27	27	27	Se.29, Oc.15 Q	1.00
Asbestos Corp. pfd.	Montreal	...	...	70	Oc.1, Oc.15, Q	1.50
SULPHUR						
Freeport Texas	New York	9⅛	8⅞	8⅞	Nov., 1919,	1.00
Texas Gulf	New York	82	78⅝	81	Se.2, Se.15, QX	1.75
PLATINUM						
So. Am. Gold & P.	N. Y. Curb	4⅛	4⅛	4⅜	...	....
MINING, SMELTING AND REFINING						
Amer. Metal	New York	48⅛	47	47⅛	Au. 18, Se. 2 Q	0.75
Amer. Metal pfd.	New York	...	...	112	Au.20, Se. 2, Q	1.75
Amer. Sm. & Ref.	New York	75⅛	73½	73⅞	Jy.11, Au. 1, Q	1.25
Amer.Sm.&Ref.pfd.	New York	103⅝	103	103	Jy.11, Au. 1,	1.25
U. S. Sm. R. & M.	New York	33	32	32	Jan., 1921,	0.50
U.S. Sm. R.&M.pfd.	New York	44⅞	44½	44½	Jy.7, Jy.15 Q	0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Colorado Springs, Colorado Springs Stock Exchange.